# Automotive Technology III

**8508 36 weeks / 280 hours**

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Acknowledgments

The components of this instructional framework were developed by the following business panelists:

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Course Description

Suggested Grade Level: 12
Prerequisites: 8507

This course prepares students to perform automotive diagnosis and repairs in the following areas: engine repair, cooling systems, transmission and transaxle, manual drive trains and axles, suspension and steering, wheel and tire, brakes, electrical/electronic systems, HVAC, and engine performance. Students are provided with more advanced instruction in all systems as they prepare for the Automotive Service Excellence (ASE) certification examinations. The Automotive Technology program provides the fundamental skills necessary to succeed in an ever-changing and challenging industry as an automotive technician.

This course is closely aligned with the ASE Education Foundation (formerly NATEF)’s 2017 standard for Automobile Service Technology (AST).

For every task in this course, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Legislation enacted in the 2011 Virginia General Assembly (HB 1493) and amended in 2012 (HB 1108) requires where there is a national industry certification for career and technical education instructional personnel or programs for automotive technology, the Board of Education must make such certification mandatory. The provisions of this act shall become effective July 1, 2013. To comply with the requirements, all Career and Technical Education (CTE) automotive technology programs must be ASE Education Foundation accredited and the instructors must be certified by the National Institute for Automotive Service Excellence (ASE).

As noted in Superintendent's Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

Task Essentials List
- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

### Required Supplemental Tasks

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Practicing Safety</strong></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>[⊕] Identify general lab/shop safety rules and procedures.</td>
</tr>
<tr>
<td>40</td>
<td>[⊕] Utilize safe procedures for handling tools and equipment.</td>
</tr>
<tr>
<td>41</td>
<td>[⊕] Identify and use proper placement of floor jacks and jack stands.</td>
</tr>
<tr>
<td>42</td>
<td>[⊕] Identify and use proper procedures for safe lift operation.</td>
</tr>
<tr>
<td>43</td>
<td>[⊕] Use proper ventilation procedures for working in the lab/shop area.</td>
</tr>
<tr>
<td>44</td>
<td>[⊕] Identify marked safety areas.</td>
</tr>
<tr>
<td>45</td>
<td>[⊕] Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.</td>
</tr>
<tr>
<td>46</td>
<td>[⊕] Identify the location and use of eye wash stations.</td>
</tr>
<tr>
<td>47</td>
<td>[⊕] Identify the location of posted evacuation routes.</td>
</tr>
<tr>
<td>48</td>
<td>[⊕] Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.</td>
</tr>
<tr>
<td>49</td>
<td>[⊕] Identify and wear appropriate clothing for lab/shop activities.</td>
</tr>
<tr>
<td>50</td>
<td>[⊕] Secure hair and jewelry for lab/shop activities.</td>
</tr>
<tr>
<td>51</td>
<td>[⊕] Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high-voltage circuits.</td>
</tr>
<tr>
<td>Task Number</td>
<td>Tasks/Competencies</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>52</td>
<td>Demonstrate awareness of the safety aspects of high-voltage circuits such as high intensity discharge (HID) lamps, ignition systems, and injection systems.</td>
</tr>
<tr>
<td>53</td>
<td>Locate and demonstrate knowledge of safety data sheets (SDS).</td>
</tr>
</tbody>
</table>

**ENGINE REPAIR**

General: Engine Diagnosis; Removal and Reinstallation (R & R)

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.</td>
</tr>
<tr>
<td>55</td>
<td>Inspect, remove, and/or replace engine mounts.</td>
</tr>
</tbody>
</table>

Cylinder Head and Valve Train Diagnosis and Repair

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten, according to manufacturer’s specifications and procedures.</td>
</tr>
<tr>
<td>57</td>
<td>Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.</td>
</tr>
<tr>
<td>58</td>
<td>Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages; determine necessary action.</td>
</tr>
<tr>
<td>59</td>
<td>Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components); verify correct camshaft timing.</td>
</tr>
<tr>
<td>60</td>
<td>Establish camshaft position sensor indexing.</td>
</tr>
</tbody>
</table>

Engine Block Assembly Diagnosis and Repair

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).</td>
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Lubrication and Cooling Systems Diagnosis and Repair
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<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>Identify causes of engine overheating.</td>
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<tr>
<td>63</td>
<td>Inspect, remove, and replace water pump.</td>
</tr>
<tr>
<td>64</td>
<td>Remove and replace radiator.</td>
</tr>
<tr>
<td>65</td>
<td>Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.</td>
</tr>
<tr>
<td>66</td>
<td>Perform oil pressure tests; determine needed action.</td>
</tr>
<tr>
<td>67</td>
<td>Inspect auxiliary coolers; determine needed action.</td>
</tr>
<tr>
<td>68</td>
<td>Inspect, test, and replace oil temperature and pressure switches and sensors.</td>
</tr>
</tbody>
</table>

**AUTOMATIC TRANSMISSION AND TRANSAXLE**

**General: Transmission and Transaxle Diagnosis**

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<th>Task Number</th>
<th>Tasks/Competencies</th>
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</thead>
<tbody>
<tr>
<td>69</td>
<td>Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action.</td>
</tr>
<tr>
<td>70</td>
<td>Diagnose fluid loss and condition concerns; determine necessary action.</td>
</tr>
<tr>
<td>71</td>
<td>Perform stall test; determine needed action.</td>
</tr>
<tr>
<td>72</td>
<td>Perform lock-up converter system tests; determine needed action.</td>
</tr>
<tr>
<td>73</td>
<td>Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.</td>
</tr>
<tr>
<td>74</td>
<td>Diagnose pressure concerns in a transmission, using hydraulic principles (Pascal’s law).</td>
</tr>
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**In-Vehicle Transmission/Transaxle Maintenance and Repair**

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<td>75</td>
<td>Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits, including computers, solenoids, sensors, relays, terminals,</td>
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<td>Task Number</td>
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<td>77</td>
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<tr>
<td>MANUAL DRIVE TRAIN AND AXLES</td>
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</tbody>
</table>
| General: Drive Train Diagnosis |      | |}
<p>| 79          |      | Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine needed action. |
| Clutch Diagnosis and Repair |      | Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action. |
| 80          |      | Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable). |
| 83          |      | Bleed clutch hydraulic system. |
| 84          |      | Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification. |
| 85          |      | Inspect flywheel and ring gear for wear and cracks; determine needed action. |
| 86          |      | Measure flywheel runout and crankshaft end play; determine needed action. |</p>
<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
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**Transmission/Transaxle Diagnosis and Repair**

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<tbody>
<tr>
<td>87</td>
<td>Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers.</td>
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**Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, and Four-wheel Drive)**

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<td>Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.</td>
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<tr>
<td>89</td>
<td>Diagnose universal joint noise and vibration concerns; perform necessary action.</td>
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<tr>
<td>90</td>
<td>Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.</td>
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**Drive Axle Diagnosis and Repair: Ring and Pinion Gears and Differential Case Assembly**

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<td>91</td>
<td>Inspect and replace companion flange and/or pinion seal; measure companion flange runout.</td>
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**Drive Axles**

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<td>92</td>
<td>Remove and replace drive axle shafts.</td>
</tr>
<tr>
<td>93</td>
<td>Inspect and replace drive axle shaft seals, bearings, and retainers.</td>
</tr>
<tr>
<td>94</td>
<td>Measure drive axle flange runout and shaft end play; determine needed action.</td>
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**Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair**

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<td>95</td>
<td>Inspect, adjust, and repair shifting controls (e.g., mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.</td>
</tr>
<tr>
<td>96</td>
<td>Identify concerns related to variations in tire circumference and/or final drive ratios.</td>
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**SUSPENSION AND STEERING**
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<td>97</td>
<td>Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.</td>
</tr>
<tr>
<td>98</td>
<td>Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).</td>
</tr>
<tr>
<td>99</td>
<td>Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.</td>
</tr>
<tr>
<td>100</td>
<td>Diagnose power steering gear (i.e., non-rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.</td>
</tr>
<tr>
<td>101</td>
<td>Diagnose power steering gear (i.e., rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.</td>
</tr>
<tr>
<td>102</td>
<td>Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock-cylinder mechanism, and steering wheel; determine needed action.</td>
</tr>
<tr>
<td>103</td>
<td>Remove and replace rack-and-pinion steering gear; inspect mounting bushings and brackets.</td>
</tr>
<tr>
<td>104</td>
<td>Remove and reinstall power steering pump.</td>
</tr>
<tr>
<td>105</td>
<td>Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.</td>
</tr>
<tr>
<td>106</td>
<td>Inspect, remove, and or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.</td>
</tr>
<tr>
<td>107</td>
<td>Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps.</td>
</tr>
<tr>
<td>108</td>
<td>Diagnose short- and long-arm suspension system noises, body sway, and uneven ride height concerns; determine needed action.</td>
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<td>117</td>
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### Related Suspension and Steering Service

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<tbody>
<tr>
<td>118</td>
<td></td>
<td>Remove, inspect, service, and/or replace front and rear wheel bearings.</td>
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</tbody>
</table>

### Wheel Alignment Diagnosis, Adjustment, and Repair

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<tbody>
<tr>
<td>119</td>
<td></td>
<td>Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action.</td>
</tr>
<tr>
<td>120</td>
<td></td>
<td>Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber, and toe as required; center steering wheel.</td>
</tr>
<tr>
<td>121</td>
<td></td>
<td>Check toe-out on turns (i.e., turning radius); determine needed action.</td>
</tr>
<tr>
<td>Task Number</td>
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<td>Tasks/Competencies</td>
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</tr>
<tr>
<td>122</td>
<td>+</td>
<td>Check steering axis inclination (SAI) and included angle; determine needed action.</td>
</tr>
<tr>
<td>123</td>
<td>+</td>
<td>Check rear-wheel thrust angle; determine needed action.</td>
</tr>
<tr>
<td>124</td>
<td>+</td>
<td>Check for front-wheel setback; determine needed action.</td>
</tr>
<tr>
<td>125</td>
<td>+</td>
<td>Check front and/or rear cradle (subframe) alignment; determine needed action.</td>
</tr>
</tbody>
</table>

**Wheels and Tires Diagnosis and Repair**

<table>
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<tr>
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<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>126</td>
<td>+</td>
<td>Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.</td>
</tr>
<tr>
<td>127</td>
<td>+</td>
<td>Measure wheel, tire, axle flange, and hub runout; determine needed action.</td>
</tr>
<tr>
<td>128</td>
<td>+</td>
<td>Diagnose tire pull problems; determine needed action.</td>
</tr>
</tbody>
</table>

**BRAKES**

**General: Brake Systems Diagnosis**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8508</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>129</td>
<td>+</td>
<td>Identify and interpret brake system concerns; determine needed action.</td>
</tr>
</tbody>
</table>

**Hydraulic System Diagnosis and Repair**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8508</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>+</td>
<td>Diagnose pressure concerns in the brake system using hydraulic principles (Pascal’s law).</td>
</tr>
<tr>
<td>131</td>
<td>+</td>
<td>Remove, bench bleed, and reinstall master cylinder.</td>
</tr>
<tr>
<td>132</td>
<td>+</td>
<td>Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.</td>
</tr>
<tr>
<td>133</td>
<td>+</td>
<td>Replace brake lines, hoses, fittings, and supports.</td>
</tr>
<tr>
<td>134</td>
<td>+</td>
<td>Fabricate brake lines, using proper material and flaring procedures (e.g., double flare and International Standards Organization [ISO] types).</td>
</tr>
<tr>
<td>135</td>
<td>+</td>
<td>Inspect, test, and/or replace components of brake warning light system.</td>
</tr>
<tr>
<td>Task Number</td>
<td>8508</td>
<td>Tasks/Competencies</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
</tbody>
</table>
| Drum Brake Diagnosis and Repair
136 | Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine needed action. |
| Disc Brake Diagnosis and Repair
137 | Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action. |
| Power-Assist Units Diagnosis and Repair
138 | Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action. |
| 139 | Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine needed action. |
| 140 | Measure and adjust master cylinder pushrod length. |
| Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair
141 | Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action. |
| 142 | Remove, reinstall, and/or replace sealed wheel bearing assembly. |
| Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) Systems Diagnosis and Repair
143 | Identify and inspect electronic brake control system components (e.g., ABS, TCS, ESC); determine needed action. |
| ELECTRICAL/ELECTRONIC SYSTEMS
General: Electrical System Diagnosis
144 | Diagnose the cause(s) of excessive key-off battery drain (i.e., parasitic draw); determine needed action. |
<table>
<thead>
<tr>
<th>Task Number</th>
<th>Repair data bus wiring harness.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting System Diagnosis and Repair</td>
<td></td>
</tr>
<tr>
<td>146</td>
<td>Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.</td>
</tr>
<tr>
<td>Charging System Diagnosis and Repair</td>
<td></td>
</tr>
<tr>
<td>147</td>
<td>Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.</td>
</tr>
<tr>
<td>Lighting Systems Diagnosis and Repair</td>
<td></td>
</tr>
<tr>
<td>148</td>
<td>Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action.</td>
</tr>
<tr>
<td>Instrument Cluster and Driver Information Systems Diagnosis and Repair</td>
<td></td>
</tr>
<tr>
<td>149</td>
<td>Inspect and test gauges and gauge sending units for causes of abnormal readings; determine needed action.</td>
</tr>
<tr>
<td>150</td>
<td>Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine needed action.</td>
</tr>
<tr>
<td>Body Electrical Systems Diagnosis and Repair</td>
<td></td>
</tr>
<tr>
<td>151</td>
<td>Describe operation of comfort and convenience accessories and related circuits (e.g., power window, power seats, pedal height, power locks, truck locks, remote start, moon roof, sun roof, sun shade, remote keyless entry, voice activation, steering wheel controls, back-up camera, park assist, cruise control, and auto dimming headlamps); determine needed repairs.</td>
</tr>
<tr>
<td>152</td>
<td>Describe operation of security/anti-theft systems and related circuits (e.g., theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed repairs.</td>
</tr>
<tr>
<td>153</td>
<td>Describe operation of entertainment and related circuits (e.g., radio, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed repairs.</td>
</tr>
<tr>
<td>Task Number</td>
<td>Tasks/Competencies</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>154</td>
<td>Describe operation of safety systems and related circuits (e.g., horn, airbags, seat belt pretensioners, occupancy classification, wipers, washers, speed control/collision avoidance, heads-up display, park assist, and back-up camera); determine needed repairs.</td>
</tr>
<tr>
<td>155</td>
<td>Describe body electronic systems circuits using a scan tool; check for module communication errors (data bus systems); determine needed action.</td>
</tr>
<tr>
<td>156</td>
<td>Describe the process for software transfer, software updates, or reprogramming of electronic modules.</td>
</tr>
</tbody>
</table>

**HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

**General: Air Conditioning (AC) System Diagnosis and Repair**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
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</thead>
<tbody>
<tr>
<td>157</td>
<td>Identify and interpret heating and air conditioning problems; determine needed action.</td>
</tr>
<tr>
<td>158</td>
<td>Test AC system; identify problems.</td>
</tr>
<tr>
<td>159</td>
<td>Identify abnormal operating noises in the A/C system; determine needed action.</td>
</tr>
<tr>
<td>160</td>
<td>Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings.</td>
</tr>
<tr>
<td>161</td>
<td>Leak test AC system; determine needed action.</td>
</tr>
<tr>
<td>162</td>
<td>Inspect condition of refrigerant oil removed from AC system; determine needed action.</td>
</tr>
<tr>
<td>163</td>
<td>Determine recommended oil and oil capacity for system application.</td>
</tr>
<tr>
<td>164</td>
<td>Observe and record related HVAC data and trouble codes, using a scan tool.</td>
</tr>
</tbody>
</table>

**Refrigeration System Component Diagnosis and Repair**

<table>
<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>165</td>
<td>Inspect, test, service, and/or replace AC compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.</td>
</tr>
<tr>
<td>Task Number</td>
<td>Tasks/Competencies</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>166</td>
<td>Remove, inspect, and reinstall AC compressor and mountings; determine recommended oil type and quantity.</td>
</tr>
<tr>
<td>167</td>
<td>Determine the need for an additional AC system filter.</td>
</tr>
<tr>
<td>168</td>
<td>Remove and inspect AC system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.</td>
</tr>
<tr>
<td>169</td>
<td>Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil type and quantity.</td>
</tr>
<tr>
<td>170</td>
<td>Remove, inspect, and install expansion valve or orifice (expansion) tube.</td>
</tr>
<tr>
<td>171</td>
<td>Inspect evaporator housing water drain; determine needed action.</td>
</tr>
<tr>
<td>172</td>
<td>Inspect and test heater control valve(s); determine needed action.</td>
</tr>
<tr>
<td>173</td>
<td>Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.</td>
</tr>
<tr>
<td>174</td>
<td>Diagnose HVAC system clutch control systems; determine needed action.</td>
</tr>
<tr>
<td>175</td>
<td>Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the HVAC system; determine needed action.</td>
</tr>
<tr>
<td>176</td>
<td>Inspect and test HVAC system control panel assembly; determine needed action.</td>
</tr>
<tr>
<td>177</td>
<td>Inspect and test HVAC system control cables, motors, and linkages; determine needed action.</td>
</tr>
<tr>
<td>178</td>
<td>Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.</td>
</tr>
<tr>
<td>179</td>
<td>Check operation of automatic or semi-automatic HVAC control systems; determine needed action.</td>
</tr>
<tr>
<td>Task Number</td>
<td>Tasks/Competencies</td>
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<tr>
<td>------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>8508</td>
<td>Refrigerant Recovery, Recycling, and Handling</td>
</tr>
<tr>
<td>180</td>
<td>Use and maintain refrigerant handling equipment, according to equipment manufacturer’s standards.</td>
</tr>
<tr>
<td>181</td>
<td>Identify AC system refrigerant; test for sealants; recover, evacuate, and charge AC system; add refrigerant oil as required.</td>
</tr>
<tr>
<td>182</td>
<td>Recycle, label, and store refrigerant.</td>
</tr>
<tr>
<td></td>
<td>ENGINE PERFORMANCE</td>
</tr>
<tr>
<td></td>
<td>General: Engine Diagnosis</td>
</tr>
<tr>
<td>183</td>
<td>Identify and interpret engine performance concerns; determine needed action.</td>
</tr>
<tr>
<td>184</td>
<td>Diagnose abnormal engine noises or vibration concerns; determine needed action.</td>
</tr>
<tr>
<td>185</td>
<td>Diagnose the cause of excessive oil consumption and unusual exhaust color, odor, and sound; determine needed action.</td>
</tr>
<tr>
<td>186</td>
<td>Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.</td>
</tr>
<tr>
<td>187</td>
<td>Verify correct camshaft timing, including variable valve timing (VVT) systems.</td>
</tr>
<tr>
<td></td>
<td>Computerized Controls Diagnosis and Repair</td>
</tr>
<tr>
<td>188</td>
<td>Research service information to perform step-by-step diagnosis (troubleshooting).</td>
</tr>
<tr>
<td>189</td>
<td>Perform active tests of actuators using a scan tool; determine needed action.</td>
</tr>
<tr>
<td></td>
<td>Ignition System Diagnosis and Repair</td>
</tr>
<tr>
<td>190</td>
<td>Diagnose (troubleshoot) ignition system-related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action.</td>
</tr>
<tr>
<td>Task Number</td>
<td>8508</td>
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<tr>
<td>-------------</td>
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</tr>
<tr>
<td>191</td>
<td></td>
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<tr>
<td>192</td>
<td></td>
</tr>
</tbody>
</table>

Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8508</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>193</td>
<td></td>
<td>Check fuel for contaminants; determine needed action.</td>
</tr>
<tr>
<td>194</td>
<td></td>
<td>Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; determine needed action.</td>
</tr>
<tr>
<td>195</td>
<td></td>
<td>Inspect throttle body, air induction system, intake manifold, and gaskets for vacuum leaks and/or unmetered air.</td>
</tr>
<tr>
<td>196</td>
<td></td>
<td>Inspect test, and/or replace fuel injectors.</td>
</tr>
<tr>
<td>197</td>
<td></td>
<td>Verify idle control operation.</td>
</tr>
<tr>
<td>198</td>
<td></td>
<td>Perform exhaust system back-pressure test; determine needed action.</td>
</tr>
</tbody>
</table>

Emissions Control Systems Diagnosis and Repair

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8508</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>199</td>
<td></td>
<td>Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.</td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service, and/or replace components of electrical/electronic sensors, controls, wiring, tubing, exhaust passages, vacuum/pressure controls, filters, and hoses of EGR system; determine necessary action.</td>
</tr>
<tr>
<td>201</td>
<td></td>
<td>Inspect and test electrical/electronically operated components and circuits of secondary air-injection systems; determine needed action.</td>
</tr>
<tr>
<td>202</td>
<td></td>
<td>Diagnose emission and driveability concerns caused by the catalytic converter system; determine needed action.</td>
</tr>
<tr>
<td>Task Number</td>
<td>8508</td>
<td>Tasks/Competencies</td>
</tr>
<tr>
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</tr>
<tr>
<td>203</td>
<td>✦</td>
<td>Inspect and test components and hoses of the evaporative emissions control (EVAP) system; determine needed action.</td>
</tr>
<tr>
<td>204</td>
<td>✦</td>
<td>Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.</td>
</tr>
</tbody>
</table>

Legend: ✦ Essential    ❏ Non-essential    ❌ Omitted

**Curriculum Framework**

**REQUIRED SUPPLEMENTAL TASKS**

**Practicing Safety**

**Task Number 39**

**Identify general lab/shop safety rules and procedures.**

**Definition**

Identification should include

- wearing correct protective eyewear and clothing
- following all Occupational Safety and Health Administration (OSHA) standards for the task performed
- following the lab/shop rules set by the local school board.

**Process/Skill Questions**

- Why is eye protection important in the automotive lab/shop?
- Why should OSHA guidelines be followed when performing service on an automobile?

**Task Number 40**

**Utilize safe procedures for handling tools and equipment.**
Definition

Utilization should include conducting a visual inspection to ensure that equipment is in good working order and always reading the manufacturer procedures for the safe use of hand tools, power tools, and equipment.

Process/Skill Questions

- Why is it essential read manufacturer procedures for the proper use of the tool?
- Why is it important for an individual to be trained on proper use of equipment and tools?

Task Number 41

Identify and use proper placement of floor jacks and jack stands.

Definition

Identification should include

- following manufacturer recommendations for jack placement
- ensuring the vehicle is on level ground before jacking
- using jacks and jack stands that are rated for the capacity of the vehicle on which the service is to be performed.

Process/Skill Questions

- Why should proper jack placement be checked?
- Why are jack stands used to support a vehicle?

Task Number 42

Identify and use proper procedures for safe lift operation.

Definition

Identification and use should include

- reviewing all lift-safety information
• identifying the correct placement of lift arms on vehicle
• lowering vehicle on safety locks before performing under-carriage service.

Process/Skill Questions

• Why is it important to read all lift-safety material supplied by the lift manufacturer?
• Why is it important to lower the vehicle onto the safety locks?

Task Number 43

Use proper ventilation procedures for working in the lab/shop area.

Definition

Use of proper ventilation procedures should include

• keeping bay doors open when possible
• operating shop exhaust fans
• using an exhaust ventilation hose on running vehicles.

Process/Skill Questions

• What are the gases emitted by a running vehicle?
• Why is proper ventilation so important?
• What are the dangers of running a vehicle engine in a confined space?

Task Number 44

Identify marked safety areas.

Definition

Identification should include describing and translating signage and special markings (e.g., floor paint) that identify work and caution areas.

Process/Skill Questions

• What are the different types of work zones?
• When is additional safety equipment or clothing needed to enter an area?
• How are walkways identified in the lab/shop area?

Task Number 45

Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.

Definition

Identification should include

• the different types of fires encountered in the automotive technology field (Classes A, B, C, and D) and the hazards and the precautions associated with each type of fire
• the locations and types fire safety equipment, including the appropriate type of extinguishers and their use and identification of relevant signage and labels
• fire emergency procedures, in accordance with government regulations, building specifications, and instructor's guidelines.

Process/Skill Questions

• How are fire extinguisher locations marked?
• What types of extinguishers are used in the automotive lab/shop?
• What other fire safety equipment might be found in an automotive lab/shop?

Task Number 46

Identify the location and use of eye wash stations.

Definition

Identification should include describing the signage and operating procedures of the eye wash station.

Process/Skill Questions
- What is the color of the sign that signifies an eye wash station?
- When should an eye wash station be used?
- What safety equipment provides additional eye protection?

---

**Task Number 47**

**Identify the location of posted evacuation routes.**

**Definition**

Identification should include

- events that could trigger an evacuation
- the location of the posted evacuation route, including destination
- interpretation of the procedures for evacuation.

**Process/Skill Questions**

- What route should be followed in the event of an evacuation?
- Where is the evacuation route posted?
- Why is it important to establish a meeting place in the case of an evacuation?

---

**Task Number 48**

**Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.**

**Definition**

Compliance should include

- wearing safety glasses at all times in the automotive lab/shop area
- wearing additional personal safety equipment, when necessary
- adhering to governmental and classroom safety policies.

**Process/Skill Questions**

- Why are safety glasses in the automotive lab/shop required at all times?
- What kinds of shoes are appropriate in the lab/shop area?
Why might ear protection be necessary in the automotive lab/shop?

Task Number 49

Identify and wear appropriate clothing for lab/shop activities.

Definition

Identification should include

- selecting clothing that will not hinder operations or be a danger to self or others
- following the school or lab/shop policy
- adhering to professional dress requirements and expectations.

Process/Skill Questions

- What can result from wearing loose clothing around moving objects in the lab/shop?
- What is the school dress code?
- What are the benefits of following standard workplace policies for apparel in the lab/shop?

Task Number 50

Secure hair and jewelry for lab/shop activities.

Definition

Securing hair and jewelry should include

- restraining hair to keep it from inadvertently getting caught in moving parts
- not wearing jewelry that can short circuit electrical components, cause electrical burns, or get caught in moving parts
- adhering to lab/shop safety policies.

Process/Skill Questions

- What is your lab/shop’s policy concerning hair safety?
- Why should long hair be tied up?
• What is the best way to secure hair so that it does not cause serious injury?

Task Number 51

Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high-voltage circuits.

Definition

Demonstration should include following manufacturer guidelines when working with supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high-voltage circuits. When working with hybrid vehicles, workers should be able to identify

• location of the battery
• physical appearance of the disconnects (i.e., small, plastic pieces that fit into the side of a hybrid battery)
• location of high voltage circuits, according to service materials and manufacturer guidelines
• specific protective gear and clothing that technicians should wear when working with the service plug (i.e., class OO insulating/voltage gloves).

Process/Skill Questions

• Why is it important to follow manufacturer guidelines when disabling an SRS?
• What could happen if the air bag deploys at the wrong time?
• What precautions should be taken when handling removed airbags?
• What are the components of electronic brake control systems?
• What are the types of electronic brake control systems?
• How does the wheel speed sensor operate?
• What color are the high voltage circuits?
• What are the shock dangers involving electric/hybrid vehicles?
• What is the electrocution threshold for humans?

Task Number 52
Demonstrate awareness of the safety aspects of high-voltage circuits such as high intensity discharge (HID) lamps, ignition systems, and injection systems.

Definition

Demonstration should include identifying the manufacturer’s warning and guidelines regarding shock hazard.

Process/Skill Questions

- What is the typical system voltage of an HID headlight?
- What gas is used in most HID bulbs?
- What do HID bulbs use in place of filaments?

---

Task Number 53

Locate and demonstrate knowledge of safety data sheets (SDS).

Definition

Demonstration should include identifying the

- purpose of SDS
- the administration’s (ownership’s) responsibility for workers’ health and safety
- laws, regulations, and practices affecting workers’ health and safety
- health and safety hazards
- health and safety programs
- the responsibility for environmental stewardship
- environmental laws, regulations, and practices
- sustainability initiatives.

Process/Skill Questions

- What environmental concerns should the automotive industry address?
- What environmentally-friendly practices and resources are available to the automotive industry?
- What methods can motivate employees to become involved in effective health, safety, and environmental practices?
ENGINE REPAIR

General: Engine Diagnosis; Removal and Reinstallation (R & R)

Task Number 54

Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

Definition

Completion should include

- customer interview worksheet
- use of troubleshooting charts
- comparison of test results to service materials and manufacturer guidelines
- an understanding of the importance of communicating what repair procedures addressed customer concern.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level I. Engine Repair
A. General: Engine Diagnosis; Removal and Reinstallation (R&R)
Task 1

Process/Skill Questions

- What is the concern, cause, correction (CCC) process?
- Why is documentation of repairs and declined repairs important to the customer, technician, and to the repair facility?

Task Number 55

Inspect, remove, and/or replace engine mounts.

Definition
Procedure should include properly supporting the engine, to include electronically controlled engine mounts, and following manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
A. General: Engine Diagnosis; Removal and Reinstallation (R&R)
  Task 8

Process/Skill Questions

• What are the different types of engine mounts?
• How does a technician test an engine mount? Why should it be tested?
• What safety precautions should be taken when removing an engine mount?

Cylinder Head and Valve Train Diagnosis and Repair

Task Number 56

Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten, according to manufacturer’s specifications and procedures.

Definition

Procedures should include

• removing cylinder head(s)
• inspecting cylinder head(s) for cracks
• checking gasket surface areas for warpage and leakage
• checking passage condition
• installing cylinder heads and gaskets
• tightening.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
B. Cylinder Head and Valve Train Diagnosis and Repair
  Task 1

Process/Skill Questions
• Why is it important to use the untightening/tightening sequence when removing/installing cylinder heads?
• What are torque-to-yield bolts? How many times can they be reused?
• Is it proper to use room-temperature vulcanizing (RTV) silicone on a head gasket? Why or why not?

Task Number 57

Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.

Definition

Procedure may include

• cleaning hot tank
• cleaning cold tank
• cleaning by sand blasting
• conducting a sonic cleaning
• conducting a visual observation of Magnaflux
• using dye penetrant
• using straightedge and feeler gauge to check for warpage
• using surface comparator to check surface finish
• cleaning and checking passage condition.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
B. Cylinder Head and Valve Train Diagnosis and Repair
Task 2

Process/Skill Questions

• What is Magnafluxing? Why is it done?
• What precautions should be taken when sand blasting a cylinder head?
• What precautions should be taken when storing a straightedge?

Task Number 58
Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages; determine necessary action.

Definition

Inspection should include conducting a visual observation to determine necessary action.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
B. Cylinder Head and Valve Train Diagnosis and Repair
Task 3

Process/Skill Questions

- How does a technician inspect for bent pushrods?
- What is the function of pushrod guides?
- What is a rocker-arm ratio?

Task Number 59

Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components); verify correct camshaft timing.

Definition

Procedures should include

- conducting a visual inspection of all associated components, including seals
- using specialized tools
- following service manuals and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
B. Cylinder Head and Valve Train Diagnosis and Repair
Task 5

Process/Skill Questions

- How often should the timing belt be checked, and when should it be replaced?
- What is the function of timing belt tensioners?
- What is variable valve timing?

Task Number 60

Establish camshaft position sensor indexing.

Definition

Establishment should include conducting a visual inspection and using specialized tools, service materials, and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
B. Cylinder Head and Valve Train Diagnosis and Repair
Task 6

Process/Skill Questions

- What is camshaft position sensor indexing?
- How and why should you check camshaft position sensor indexing?
- What type of ignition system requires cam sensor indexing?

Engine Block Assembly Diagnosis and Repair

Task Number 61

Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).

Definition
Procedures should include conducting a visual inspection, using required puller and installation tools, and following manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
C. Engine Block Assembly Diagnosis and Repair
Task 1

Process/Skill Questions

• What tools should be used to remove a crankshaft vibration damper?
• How should the technician remove, inspect, and replace a crankshaft vibration damper?
• What safety precautions should the technician follow?

Lubrication and Cooling Systems Diagnosis and Repair

Task Number 62

Identify causes of engine overheating.

Definition

Identification might include the following:

• Thermostat stuck closed
• Low coolant
• Ignition timing
• Clogged exhaust
• Head gasket issues
• Low engine oil
• Inoperative cooling fan
• Inoperative water pump
• Malfunctioning drive belt
• Clogged radiator (internal)
• Airflow blockage
• Overloaded vehicle
• Internal engine deposits

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
D. Lubrication and Cooling Systems Diagnosis and Repair

Task 2

Process/Skill Questions

- At what temperature is an engine considered to be overheated?
- What is indicated by white smoke being emitted from the exhaust pipe?
- What safety precautions should be followed when working on an overheated engine?

Task Number 63

Inspect, remove, and replace water pump.

Definition

Procedure should include following manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
D. Lubrication and Cooling Systems Diagnosis and Repair
Task 5

Process/Skill Questions

- How should a technician inspect a water pump? How often should it be inspected?
- What are the procedures to replace a water pump?
- What precautions should be taken when replacing a water pump?

Task Number 64

Remove and replace radiator.

Definition

Procedures should include following manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
D. Lubrication and Cooling Systems Diagnosis and Repair
Task 6

Process/Skill Questions

- What are the steps for replacing a radiator?
- What precautions should be taken when replacing a radiator?
- What tools are needed to replace a radiator?

Task Number 65

Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.

Definition

Inspection should include following manufacturer guidelines and using

- infrared thermometer
- scan tool.

Task Number 66

Perform oil pressure tests; determine needed action.

Definition
Performance should include

- conducting a visual inspection
- using mechanical oil pressure gauge
- following manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
D. Lubrication and Cooling Systems Diagnosis and Repair
Task 9

Process/Skill Questions

- When should an oil pressure test be performed?
- What can result from vehicles that continue to operate with low oil pressure?
- Where does the oil pressure gauge attach to the engine?

Task Number 67

Inspect auxiliary coolers; determine needed action.

Definition

Inspection should include following manufacturer guidelines and using an infrared thermometer.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
I. Engine Repair
D. Lubrication and Cooling Systems Diagnosis and Repair
Task 11

Process/Skill Questions

- What is the purpose of using auxiliary coolers?
- What might happen if an auxiliary cooler becomes clogged?
- Where are auxiliary coolers typically located?

Task Number 68
Inspect, test, and replace oil temperature and pressure switches and sensors.

**Definition**

Procedures should include following manufacturer guidelines and using a graphing multimeter.

ASE Education Foundation  
2017 Automobile Service Technology (AST) Level  
I. Engine Repair  
D. Lubrication and Cooling Systems Diagnosis and Repair  
Task 12

**Process/Skill Questions**

- Where are oil and pressure switches typically located?
- How should pressure switches be inspected and tested?
- How are oil and pressure switches replaced?

AUTOMATIC TRANSMISSION AND TRANSAXLE

**General: Transmission and Transaxle Diagnosis**

**Task Number 69**

Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action.

**Definition**

Procedure should include

- verifying customer concern
- determining proper function of any transmission/transaxle component
• comparing component and function to a similar vehicle, if needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
II. Automatic Transmission and Transaxle
A. General: Transmission and Transaxle Diagnosis

Task 1

Process/Skill Questions

• What tools are used in automatic transmission repair?
• What concerns are associated with an automatic transmission system?
• What is the first step in dealing with an automatic transmission concern?

Task Number 70

Diagnose fluid loss and condition concerns; determine necessary action.

Definition

Procedures should include

• conducting a visual inspection for leaks
• checking fluid loss, fluid level, and condition (e.g., color, odor)
• following manufacturer recommendations for checking fluid level/loss/service requirements
• cleaning affected area
• reevaluating using dye trace and black light
• recommending adjustments and necessary repairs.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
II. Automatic Transmission and Transaxle
A. General: Transmission and Transaxle Diagnosis

Task 3

Process/Skill Questions

• What are the procedures for checking fluid levels in various transmissions/transaxles?
• How should fluid condition be checked?
• How should automatic transmission fluid be serviced?
Task Number 71

Perform stall test; determine needed action.

Definition

Performance should include

- using an analyzer and vehicle data
- following manufacturer guidelines.

Task Number 72

Perform lock-up converter system tests; determine needed action.

Definition

Procedures should include using service information to test and repair the torque converter lock-up system.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
II. Automatic Transmission and Transaxle
A. General: Transmission and Transaxle Diagnosis
Task 7
Process/Skill Questions

- What are some possible causes of torque converter clutch (TCC) failure?
- What test equipment should be used?
- What repair procedures should be used?

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**Task Number 73**

Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.

**Definition**

Diagnosis should include analyzing the planetary gear operation.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level II. Automatic Transmission and Transaxle A. General: Transmission and Transaxle Diagnosis Task 8

Process/Skill Questions

- What is the function of the planetary unit? What is the function of the compound planetary unit?
- What is held in low gear if power is supplied to the sun gear?
- What components are used to hold and drive planetary members?

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**Task Number 74**

Diagnose pressure concerns in a transmission, using hydraulic principles (Pascal’s law).

**Definition**

Diagnosis should include using Pascal's law to analyze transmission hydraulic circuit operation.
Process/Skill Questions

- How can Pascal's law explain the operation of valve bodies?
- What electronic components are used to control hydraulic circuits?
- What applies pressure to hydraulic circuits?

In-Vehicle Transmission/Transaxle
Maintenance and Repair

Task Number 75

Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits, including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; demonstrate understanding of relearn procedure.

Definition

Procedures should include using a scan tool, digital multimeter (DMM), or test light to inspect and test electronic components and, if necessary, replace them.

Process/Skill Questions

- What tools are used to inspect, test, and diagnose problems with electrical/electronic components?
- What are the procedures for checking shift solenoids?
- What are some possible failures of relays, switches, and harnesses?
Off-Vehicle Transmission and Transaxle Repair

Task Number 76

Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mounting surfaces.

Definition

Procedures should include

- removing transmission
- flushing and checking cooler
- aligning transmission to engine
- replacing transmission.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level II. Automatic Transmission and Transaxle
C. Off-Vehicle Transmission and Transaxle Repair
Task 1

Process/Skill Questions

- What tools are used to remove and reinstall the transmission/transaxle?
- Why is transmission-to-engine alignment critical?
- Why do engine core plugs need to be inspected?

Task Number 77

Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.

Definition

Procedures should include
• using proper equipment to flow test and flush transmission oil cooler and lines
• inspecting or replacing oil cooler, lines, and fittings, as needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
II. Automatic Transmission and Transaxle
C. Off-Vehicle Transmission and Transaxle Repair
Task 2

Process/Skill Questions

• What is the normal flow rate through a transmission/transaxle cooler?
• Why is a transmission/transaxle cooler flushed?
• What factors indicate that the cooler needs to be replaced?

Task Number 78

Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.

Definition

Inspection should include checking

• plate for cracks
• converter ring gear teeth
• crankshaft bore
• front pump bushing.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
II. Automatic Transmission and Transaxle
C. Off-Vehicle Transmission and Transaxle Repair
Task 3

Process/Skill Questions

• What should the technician look for when inspecting a converter flex (drive) plate?
• How is converter input checked?
• What should the crankshaft pilot bore look like?
MANUAL DRIVE TRAIN AND AXLES

General: Drive Train Diagnosis

Task Number 79

Identify and interpret drive train concerns; determine needed action.

Definition

Interpretation should include

- determining proper function of any drive train component
- comparing component and function to a similar vehicle, if needed
- verifying customer concern.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
A. General: Drive Train Diagnosis
Task 1

Process/Skill Questions

- What tools are used in manual drive train and axle repair?
- What concerns are associated with a manual drive train and axle system?
- What is the first step in dealing with a manual drive train and axle system concern?

Clutch Diagnosis and Repair

Task Number 80

Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.

Definition

Procedures should include disengaging and engaging clutch and checking for unwanted operation (e.g., pedal free play, engagement).
ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
B. Clutch Diagnosis and Repair
Task 1

Process/Skill Questions

- What procedures are used to diagnose clutch noise?
- What are causes of clutch slippage?
- What would prevent a clutch from disengaging?

Task Number 81

Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine needed action.

Definition

Inspection should include checking clutch mechanical linkage and repairing or replacing as necessary.

Task Number 82

Process/Skill Questions

- What are the procedures for inspecting the clutch pedal?
- Why is clutch pedal free play important?
- How is a clutch pedal adjusted?
Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).

Definition

Procedures should include checking for damaged (e.g., bluing) pressure plate disc and pilot bearing/bushing and repairing or replacing, as needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
B. Clutch Diagnosis and Repair
Task 3

Process/Skill Questions

- What tools are used to replace the clutch assembly?
- How does the technician determine if the clutch needs replacement?
- How does the technician determine when a pilot bearing/bushing needs replacement?

Task Number 83

Bleed clutch hydraulic system.

Definition

Procedure should include flushing and bleeding the hydraulic system, as needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
B. Clutch Diagnosis and Repair
Task 4

Process/Skill Questions

- What are the procedures for bleeding the clutch hydraulic system?
- What safety precautions should be followed when bleeding the clutch hydraulic system?
- What circumstances would require the technician to bleed the hydraulic system?
Task Number 84

Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.

Definition

Procedure should include checking for leaks and proper operation and repairing or replacing as necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
B. Clutch Diagnosis and Repair
Task 5

Process/Skill Questions

- What type of fluid goes into a hydraulic clutch system?
- What are some failures of a hydraulic clutch system?
- How are internal and external fluid leaks checked?

Task Number 85

Inspect flywheel and ring gear for wear and cracks; determine needed action.

Definition

Inspection should include checking the flywheel and ring gear and for broken teeth and other damage and repairing or replacing, as necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
B. Clutch Diagnosis and Repair
Task 6
Process/Skill Questions

- What tools are used for inspecting the flywheel and ring gear?
- What procedures are used for inspecting the flywheel and ring gear?
- When is replacement of the flywheel and ring gear necessary?

Task Number 86

Measure flywheel runout and crankshaft end play; determine needed action.

Definition

Measurements should be made by using a dial indicator that should determine whether repairs are required.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
B. Clutch Diagnosis and Repair
Task 7

Process/Skill Questions

- What tools are used to measure flywheel runout and crankshaft end play?
- Where are the specifications for measuring flywheel runout and crankshaft end play found?
- What are the causes of excessive crankshaft end play or runout?

Transmission/Transaxle Diagnosis and Repair

Task Number 87

Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers.

Definition
Procedures should include inspecting and/or replacing shift mechanism components.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
C. Transmission/Transaxle Diagnosis and Repair
Task 1

Process/Skill Questions

- What are the proper procedures for inspecting, adjusting, and reinstalling shift linkages?
- What might result from an incorrect shift linkage adjustment?
- What might be the cause of gear tie-up?

Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, and Four-wheel Drive)

Task Number 88

Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.

Definition

Diagnosis should include checking and inspecting CV joints and repairing as necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, and Four-wheel Drive)
Task 1

Process/Skill Questions

- How would a road test verify CV joint noise and/or vibration concerns?
- How would a technician determine the cause of CV joint noise and/or vibration?
- What are causes of joint failure?
Task Number 89

Diagnose universal joint noise and vibration concerns; perform necessary action.

Definition

Diagnosis should include checking the universal joint drive operation (e.g., for locked-up or worn condition).

ASE Education Foundation
2017 Automobile Service Technology (AST) Level III. Manual Drive Train and Axles
D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, and Four-wheel Drive)
Task 2

Process/Skill Questions

- What is the procedure for checking universal joint failures?
- What is the procedure for checking drive shaft imbalance?
- How are driveline angles aligned?

Task Number 90

Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.

Definition

Procedures should include using a dial indicator to check

- driveshaft and yoke runout
- driveline angles
- proper alignment of joints.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level III. Manual Drive Train and Axles
D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, and Four-wheel Drive)
Task 5

Process/Skill Questions

- How does a technician properly phase a two-piece drive shaft?
- How are driveline angles adjusted?
- Why are phasing and driveline angles important?

Drive Axle Diagnosis and Repair: Ring and Pinion Gears and Differential Case Assembly

Task Number 91

Inspect and replace companion flange and/or pinion seal; measure companion flange runout.

Definition

Procedures should include

- checking differential yoke for runout
- checking seal
- replacing companion flange and seal, if necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
E. Drive Axle Diagnosis and Repair
E.1 Ring and Pinion Gears and Differential Case Assembly
Task 4

Process/Skill Questions

- What are the procedures for replacing the companion flange?
- What tools are used to check runout?
- What failure can result from an improperly torqued pinion nut?

Drive Axles
Task Number 92

Remove and replace drive axle shafts.

Definition

Procedures should include removing wheel and axle and replacing axle, according to manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
E. Drive Axle Diagnosis and Repair
E.2 Drive Axles
Task 2

Process/Skill Questions

- What is the procedure for removing drive axle shafts?
- What tools are used to remove drive axle shafts?
- Why might an axle shaft need replacement?

Task Number 93

Inspect and replace drive axle shaft seals, bearings, and retainers.

Definition

Procedures should include

- removing wheel and axle assembly
- replacing bearings, seals, and retainers.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
E. Drive Axle Diagnosis and Repair
E.2 Drive Axles
Task 3
Process/Skill Questions

- What tools are needed to replace drive axle shaft seals, bearings, and retainers?
- What are the procedures for replacing drive axle shaft seals, bearings, and retainers?
- How is a drive axle shaft seal inspected?

Task Number 94

Measure drive axle flange runout and shaft end play; determine needed action.

Definition

Measurements should include use of a dial indicator mounted to the axle flange to determine runout. If runout exceeds manufacturer guidelines, it should be replaced.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
E. Drive Axle Diagnosis and Repair
E.2 Drive Axles
Task 4

Process/Skill Questions

- What tools are used to measure drive axle flange runout and shaft end play?
- How would the technician adjust excessive runout or end play?
- What would excessive runout cause?

Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair

Task Number 95

Inspect, adjust, and repair shifting controls (e.g., mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.
Definition

Procedures should include checking shifting controls, bushings, mounts, levers, brackets, and other related components and replacing when necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair
Task 1

Process/Skill Questions

- What procedures are used to inspect, adjust, and repair shifting controls (e.g., mechanical, electrical, vacuum), bushings, mounts, levers, and brackets?
- What is the location of the vacuum routing for the front differential actuator?
- How is the source vacuum for the shift controls checked?

Task Number 96

Identify concerns related to variations in tire circumference and/or final drive ratios.

Definition

Identification should include describing concerns with final drives on vehicles with tires of varying circumferences.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
III. Manual Drive Train and Axles
F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair
Task 4

Process/Skill Questions

- How can tire size affect shifting in a four-wheel drive vehicle?
- What effect would two different-size tires have on a differential if placed on the same axle?
- What procedures would be used to change tire size on a vehicle?
SUSPENSION AND STEERING

Steering Systems Diagnosis and Repair

Task Number 97

Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.

Definition

Procedure should include following manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
B. Steering Systems Diagnosis and Repair
Task 1

Process/Skill Questions

• Why is it important to follow manufacturer guidelines when disabling an SRS?
• What could happen if the air bag deploys at the wrong time?
• What precautions should be taken when handling removed airbags?

Task Number 98

Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).

Definition

Procedure should include

• deactivating SRS
• using a steering wheel puller
• following manufacturer guidelines.
Process/Skill Questions

- What is the function of the clock spring?
- What precautions should be taken when working with the clock spring?
- Where would the technician find procedures for centering the clock spring?
- What procedure should be followed when removing a steering wheel?

Task Number 99

Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.

Definition

Diagnosis should include

- conducting a visual inspection
- following manufacturer guidelines and specifications.
Task Number 100

Diagnose power steering gear (i.e., non-rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.

Definition

Diagnosis should include conducting a visual inspection and following manufacturer guidelines and specifications.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
B. Steering Systems Diagnosis and Repair
Task 4

Process/Skill Questions

- How might you distinguish between steering gear problems and steering knuckle problems?
- What is the difference between flexible coupling looseness and sector shaft misadjustment?
- How is the steering gear mount integrity tested?

Task Number 101

Diagnose power steering gear (i.e., rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.

Definition

Diagnosis should include conducting a visual inspection, according to state inspection procedures, and following manufacturer guidelines and specifications.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
B. Steering Systems Diagnosis and Repair
Task 5

Process/Skill Questions

- What causes "morning sickness" (i.e., hard steering when cold)?
- What should the technician look for during a visual inspection?
- How does power steering fluid color and condition affect performance?

Task Number 102

Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock-cylinder mechanism, and steering wheel; determine needed action.

Definition

Procedure should include conducting a visual inspection, according to state inspection standards, and following manufacturer guidelines and specifications.

Task Number 103

Remove and replace rack-and-pinion steering gear; inspect mounting bushings and brackets.

Definition
Procedure should include conducting a visual inspection, according to state inspection standards, and following manufacturer guidelines and specifications.

ASE Education Foundation  
2017 Automobile Service Technology (AST) Level  
IV. Suspension and Steering  
B. Steering Systems Diagnosis and Repair  
Task 7

Process/Skill Questions  

• What would happen if mounting bushings failed?  
• Why is an alignment needed after replacing the steering gear?  
• Why would the power steering system need flushing after the replacement of the steering gear?

Task Number 104  

Remove and reinstall power steering pump.

Definition

Procedure should include the use of hand tools and a pulley remover/installer.

ASE Education Foundation  
2017 Automobile Service Technology (AST) Level  
IV. Suspension and Steering  
B. Steering Systems Diagnosis and Repair  
Task 13

Process/Skill Questions  

• What is the function of the power steering pump?  
• What is the effect of power steering on a hydro-boost braking system?  
• Why would a power steering pump need to be replaced?  
• Should power steering lines always be replaced when the pump is replaced? Why or why not?

Task Number 104
Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.

Definition

Procedure should include the use of a pulley remover/installer, followed by a visual inspection.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
B. Steering Systems Diagnosis and Repair
Task 14

Process/Skill Questions

- What are the hazards of using makeshift removal and installation tools?
- Why is it important to use a puller when removing the pulley?
- What would happen if the pulley were misaligned?

Task Number 106

Inspect, remove, and or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.

Definition

Procedure should include using front-end puller set and impact wrench with impact socket set.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
B. Steering Systems Diagnosis and Repair
Task 16

Process/Skill Questions

- Why should a front-end puller set be used?
- What is the disadvantage of using a pickle fork?
- What is the proper way to install a cotter pin?
Task Number 107

Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps.

Definition

Procedure should include using hand tools and an alignment machine to align front end to manufacturer specifications.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
B. Steering Systems Diagnosis and Repair
Task 17

Process/Skill Questions

- How should the clamp be aligned to the adjuster sleeve? Why is this important?
- Why is anti-seize important to use?
- What might be the consequences of using heat for straightening steering components?

Suspension Systems Diagnosis and Repair

Task Number 108

Diagnose short- and long-arm suspension system noises, body sway, and uneven ride height concerns; determine needed action.

Definition

Diagnosis should include

- conducting a visual inspection, according to state inspection procedures
- measuring ride height, according to manufacturer specifications.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
Process/Skill Questions

- What advantages does a short- and long-arm suspension system have over a solid axle suspension system, or over the twin I-beam?
- How does ride height affect camber?
- How do weak rear springs affect caster?

Task Number 109

Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action.

Definition

Diagnosis should include

- conducting a visual inspection, according to state inspection procedures
- measuring ride height, according to manufacturer specifications.

Process/Skill Questions

- Does the lower ball joint support the load of the vehicle? Explain.
- What are the differences between a MacPherson strut and a modified strut suspension system?
- Where does the technician place the jack when checking the ball joint on a MacPherson strut suspension?
- Where does the technician place the jack when checking the load-carrying ball joint on a modified strut suspension?

Task Number 110
Inspect, remove and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers.

Definition

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
C. Suspension Systems Diagnosis and Repair
Task 3

Process/Skill Questions

- What safety precautions should be taken when servicing the spring/torsion bar?
- When is it acceptable to torque the control-arm bushings?
- Why is it necessary to preserve alignment angles when removing components?

Task Number 111

Inspect, remove, and/or replace strut rods and bushings.

Definition

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
C. Suspension Systems Diagnosis and Repair
Task 4

Process/Skill Questions
What are some methods of preserving alignment when servicing strut rods and bushings? Why is this important?
How do strut rods and bushings affect caster and braking?
Will a bent strut rod cause a vehicle to pull? Explain.

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**Task Number 112**

**Inspect, remove and/or replace steering knuckle assemblies.**

**Definition**

Procedure should include

- conducting a visual inspection according to state inspection procedures
- using specialized tools according to manufacturer guidelines.

**Process/Skill Questions**

- What precautions should be taken when servicing steering knuckle assemblies?
- What is the preferred method for separating the ball joint if it is to be reused?
- What is the proper torquing procedure for a castellated nut?

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**Task Number 113**

**Inspect, remove, and/or replace short- and long-arm suspension system coil springs and spring insulators.**

**Definition**

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.
Task Number 114

Inspect, remove, and/or replace torsion bars and mounts.

Definition

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

Task Number 115

Process/Skill Questions

- Are torsion bars interchangeable from one side to the other? Explain.
- What are the effects of compromising the integrity of a torsion bar through application of a stress raiser?
- What safety precautions should be taken when servicing torsion bars?
Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.

Definition

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

Process/Skill Questions

- What is the purpose of the stabilizer bar, and how does it work?
- What effect would changing the diameter of the stabilizer bar have on vehicle handling?
- How does the condition of sway bar bushings affect vehicle handling?

Task Number 116

Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.

Definition

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

Process/Skill Questions
• What is a strut compressor?
• What safety precautions should be taken when compressing the spring to protect the technicians and the spring?
• When should the upper strut bearing mount be checked? Explain.

Task Number 117

Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.

Definition

Procedure should include

• conducting a visual inspection, according to state inspection procedures
• using specialized tools, according to manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
C. Suspension Systems Diagnosis and Repair
Task 12

Process/Skill Questions

• What safety precautions should be taken when handling leaf springs?
• What is the purpose of the center bolt? How can it affect alignment?
• What is the purpose of the spring shackle?

Related Suspension and Steering Service

Task Number 118

Remove, inspect, service, and/or replace front and rear wheel bearings.

Definition
Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
D. Related Suspension and Steering Service
Task 2

Process/Skill Questions

- What is the difference between a serviceable wheel bearing and a sealed wheel bearing?
- What is the difference between a tapered wheel bearing and a ball bearing?
- How would one describe the typical adjustment of a tapered wheel bearing?

Wheel Alignment Diagnosis, Adjustment, and Repair

Task Number 119

Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action.

Definition

Diagnosis should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools (e.g., bump steer gauge, alignment machine), according to manufacturer guidelines.
Task Number 120

Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber, and toe as required; center steering wheel.

Definition

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines
- understanding the difference between a mechanical steering system and an electrical steering system and the procedure for recalibration.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level IV. Suspension and Steering E. Wheel Alignment, Diagnosis, Adjustment, and Repair Task 3

Process/Skill Questions

- How does the technician prepare a vehicle for wheel alignment?
- What is a sweeping caster?
- What are methods used to offset road crown?
- How does four-wheel alignment compare with thrust-angle alignment?

Task Number 121

Check toe-out on turns (i.e., turning radius); determine needed action.
Definition

Check should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

Process/Skill Questions

- How much difference can there be between steering axis inclination (SAI) and included angle?
- How would a technician use SAI and included angle to determine if a strut or a knuckle is bent?
- Is SAI adjustable? Explain.
- What are the key differences between positive and negative scrub radius? How does scrub radius affect the braking system?

Task Number 122

Check steering axis inclination (SAI) and included angle; determine needed action.

Definition

Check should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.
• How much difference can there be between SAI and the included angle?
• How would a technician use SAI and the included angle to determine if a strut or a knuckle is bent?
• Is SAI adjustable? Explain.
• What are the key differences between positive and negative scrub radius? How does scrub radius affect the braking system?

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**Task Number 123**

**Check rear-wheel thrust angle; determine needed action.**

**Definition**

Check should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

**ASE Education Foundation**

2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
E. Wheel Alignment, Diagnosis, Adjustment, and Repair
Task 6

**Process/Skill Questions**

- What is rear-wheel thrust angle?
- What are the effects of excessive thrust angle?
- What is the difference between positive and negative thrust angle?

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**Task Number 124**

**Check for front-wheel setback; determine needed action.**

**Definition**

Check should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.
ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
E. Wheel Alignment, Diagnosis, Adjustment, and Repair
Task 7

Process/Skill Questions

- What is the leading cause of front-wheel setback?
- What is the difference between positive and negative setback?
- What effect does setback have on the wheel base?

Task Number 125

Check front and/or rear cradle (subframe) alignment; determine needed action.

Definition

Procedure should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines.

Task Number 126

Wheels and Tires Diagnosis and Repair

Task Number 128
Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.

Definition

Diagnosis should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines
- checking for road force variation and tire/wheel runout.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
F. Wheels and Tires Diagnosis and Repair
Task 2

Process/Skill Questions

- How is wheel/tire runout measured?
- What are common causes of wheel/tire vibration, shimmy, and noise?
- What causes a tire to flat spot?

Task Number 127

Measure wheel, tire, axle flange, and hub runout; determine needed action.

Definition

Measurement should include

- conducting a visual inspection, according to state inspection procedures
- using specialized tools, according to manufacturer guidelines
- checking for road force variation and tire/wheel runout.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
F. Wheels and Tires Diagnosis and Repair
Task 4
Process/Skill Questions

- What would cause an axle flange to have runout?
- Why is it important to ensure the face of the axle flange is clean before mounting wheels or rotors?
- What is the difference between lateral and radial runout?

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Task Number 128

Diagnose tire pull problems; determine needed action.

Definition

Diagnosis includes

- conducting a visual inspection, according to state inspection procedures
- checking tire pressure
- rotating front tires.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
IV. Suspension and Steering
F. Wheels and Tires Diagnosis and Repair
Task 5

Process/Skill Questions

- What is tire stagger? How does it cause a vehicle to pull?
- What are the similarities and differences between radial pull and a slipped belt?
- How does tire inflation affect tire pull?
- How can tire rotation affect the tire pressure monitoring system (TPMS)?

BRAKES

General: Brake Systems Diagnosis

Task Number 129
Identify and interpret brake system concerns; determine needed action.

Definition

Interpretation should include

- determining proper function of any brake system component
- comparing component and function to a similar vehicle, if needed
- verifying customer concern.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
A. General: Brake Systems Diagnosis
Task 1

Process/Skill Questions

- What tools are used in brake repair?
- What concerns are associated with a brake system?
- What is the first step in dealing with a brake system concern?

Hydraulic System Diagnosis and Repair

Task Number 130

Diagnose pressure concerns in the brake system using hydraulic principles (Pascal’s law).

Definition

Diagnosis should include checking

- metering process
- pressure differential and proportion valves
- master cylinder
- hydraulic hoses and lines and wheel brakes.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
B. Hydraulic System Diagnosis and Repair
Task 1

Process/Skill Questions

- What is Pascal's law?
- How does Pascal's law apply to the brake system?
- What are the differences between input piston size and output piston size?

Task Number 131

Remove, bench bleed, and reinstall master cylinder.

Definition

Procedures should include

- using tools to bleed and install master cylinder and check pushrod length
- understanding safety concerns related to brake fluid.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
B. Hydraulic System Diagnosis and Repair
Task 4

Process/Skill Questions

- Why should a technician bench bleed a master cylinder?
- After installation, does the technician need to bleed the entire system? Why or why not?
- What precautions should the technician follow when removing a master cylinder?

Task Number 132

Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.

Definition
Diagnosis should include verifying the customer complaint and determining possible causes.

ASE Education Foundation  
2017 Automobile Service Technology (AST) Level  
V. Brakes  
B. Hydraulic System Diagnosis and Repair  
Task 5  

Process/Skill Questions

- What can cause poor stopping?  
- What are possible causes of brake dragging?  
- What hydraulic issue can cause pulling or dragging?  
- How does coefficient of friction affect braking performance?  
- How does heat affect braking performance?

Task Number 133  

Replace brake lines, hoses, fittings, and supports.  

Definition  

Procedures should include removing components and replacing them.

Task Number 134
Fabricate brake lines, using proper material and flaring procedures (e.g., double flare and International Standards Organization [ISO] types).

Definition

Fabrication should include using flaring, cutting, and bending tools to complete the task.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
B. Hydraulic System Diagnosis and Repair
Task 8

Process/Skill Questions

• What is the difference between flare and double flare, according to the International Standards Organization (ISO)?
• What tool is used to cut brake pipe?
• What material is typically used for the brake line?

Task Number 135

Inspect, test, and/or replace components of brake warning light system.

Definition

Procedures should include using a digital multimeter (DMM) or test light to indicate failed components.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
B. Hydraulic System Diagnosis and Repair
Task 10

Process/Skill Questions

• What is the purpose of the brake warning light?
• How is a brake warning light tested?
What will activate the brake warning light?

Drum Brake Diagnosis and Repair

Task Number 136

Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine needed action.

Definition

Procedures should include checking for out-of-round, scored, cracked, or damaged brake hardware and for hot spots or excessive heat.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
C. Drum Brake Diagnosis and Repair
Task 1

Process/Skill Questions

- What is pedal pulsation?
- What are possible causes of pulling while braking?
- What are possible causes of dragging brakes?

Disc Brake Diagnosis and Repair

Task Number 137

Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.

Definition

Diagnosis should include checking for

- warping
- thickness variation
• scoring
• heat
• hot spots
• cracks
• frozen or binding caliper pistons or slides.

Diagnosis should also include replacing or repairing, as necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
D. Disc Brake Diagnosis and Repair
Task 1

Process/Skill Questions

• What is pedal pulsation?
• What are possible causes of pulling while braking?
• What are possible causes of dragging brakes?

Power-Assist Units Diagnosis and Repair

Task Number 138

Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action.

Definition

Inspection should include

• listening for noise (e.g., hissing, air leaks)
• depressing brake pedal and releasing
• checking reserve
• restarting engine.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
E. Power-Assist Units Diagnosis and Repair
Task 1
Process/Skill Questions

- How does a vacuum booster operate?
- What are the procedures to inspect and check the operation of a vacuum booster?
- What is the operation of the check valve and vacuum valve?

Task Number 139

Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine needed action.

Definition

Inspection should include

- power steering system
- hoses
- hydroboost system.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
E. Power-Assist Units Diagnosis and Repair
Task 4

Process/Skill Questions

- What is the operation of a hydroboost system?
- What part of the hydroboost unit acts as a reserve?
- What might cause a hard brake pedal?

Task Number 140

Measure and adjust master cylinder pushrod length.

Definition

Procedures should include using proper tools to remove master cylinder and to adjust the master cylinder pushrod, according to manufacturer guidelines.
Process/Skill Questions

- Why would a technician have to check and/or adjust a master cylinder pushrod?
- What are the procedures to adjust the master cylinder pushrod?
- What tool is used to adjust the master cylinder pushrod?

Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair

Task Number 141

Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action.

Definition

Diagnosis should include

- the ability to locate and isolate faulty wheel bearings
- an understanding of noise, vibration, and harshness (NVH)
- a description of tools used to address NVH.

Process/Skill Questions

- Why might a vehicle need to be road-tested?
- How would a technician isolate a noise during and after a road test?
- What are some possible causes for wheel bearing failure?
Task Number 142

Remove, reinstall, and/or replace sealed wheel bearing assembly.

Definition

Procedures should include removing bearing assembly and replacing it, according to manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
V. Brakes
F. Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical) Diagnosis and Repair
Task 8

Process/Skill Questions

- What are the types of sealed wheel bearing assemblies?
- What are the tools needed to replace a sealed wheel bearing assembly?
- What might result from a worn or loose wheel bearing?

Electronic Brake Control Systems: Antilock Brake (ABS), Traction Control (TCS), and Electronic Stability Control (ESC) Systems Diagnosis and Repair

Task Number 143

Identify and inspect electronic brake control system components (e.g., ABS, TCS, ESC); determine needed action.

Definition

Procedures should include determining braking components and their proper operation.
Process/Skill Questions

- What are the components of electronic brake control systems?
- What are the types of electronic brake control systems?
- How does the wheel speed sensor operate?

ELECTRICAL/ELECTRONIC SYSTEMS

General: Electrical System Diagnosis

Task Number 144

Diagnose the cause(s) of excessive key-off battery drain (i.e., parasitic draw); determine needed action.

Definition

Diagnosis should include

- measuring draw, according to manufacturer standards, using an ammeter with a fused jumper lead
- determining the cause by isolating the excessively drawing circuit by methodically disabling/disconnecting portions of the circuits or components from maxifuses to minifuses.

Process/Skill Questions

- What is the typical allowable range for a parasitic draw?
- What is key-off load?
• How would a technician perform a parasitic draw test?
• Why might a technician need to conduct this test?

Task Number 145

Repair data bus wiring harness.

Definition

Repair should include

• examining routing
• detecting twisted pairings
• using specialized tools
• referring to service manuals and manufacturer guidelines.

Process/Skill Questions

• Why would a technician use heat shrink vs. tape insulation?
• Why are Controller Area Network (CAN) bus wires twisted?
• Why is soldering typically the preferred repair method?

Starting System Diagnosis and Repair

Task Number 146

Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.

Definition

Differentiation should include physically turning over the engine with a breaker bar. (Note: If the engine turns normally, according to vehicle make and age, the problem is electrical.)

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VI. Electrical/Electronic Systems
C. Starting System Diagnosis and Repair
Task 6
Process/Skill Questions

- What mechanical problem could cause a slow crank?
- What is the voltage of a fully charged car battery?
- What is the available cold cranking amperage (CCA) of the battery?
- What could cause a no-crank condition?

Charging System Diagnosis and Repair

Task Number 147

Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.

Definition

Diagnosis should include

- reference to service materials and manufacturer guidelines
- use of recommended testing equipment.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VI. Electrical/Electronic Systems
D. Charging System Diagnosis and Repair
Task 2

Process/Skill Questions

- What might be the effect of a loose belt?
- What would a wet battery indicate?
- What is the effect of revolutions per minute (RPM)/idle speed being too low?

Lighting Systems Diagnosis and Repair

Task Number 148

Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action.
Definition

Diagnosis should include testing the bulb for

- continuity and wattage
- voltage source
- ground
- terminal fit/connection
- resistance in the wiring (voltage drop test).

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VI. Electrical/Electronic Systems
E. Lighting Systems Diagnosis and Repair
Task 1

Process/Skill Questions

- What would cause a brighter-than-normal light?
- How would a loose connection affect the light?
- How would high resistance affect the light?

Instrument Cluster and Driver Information Systems Diagnosis and Repair

Task Number 149

Inspect and test gauges and gauge sending units for causes of abnormal readings; determine needed action.

Definition

Procedure should include

- inspecting, testing, and replacing oil temperature and pressure switches and sensors
- checking operation of parking brake indicator light system
- checking operation of brake stop light system and adjusting and servicing, as needed
- diagnosing intermittent, high, low, or no gauge readings
- testing gauge circuit voltage regulators (limiters) and replacing as needed
- inspecting and testing gauges and gauge sending units and replacing, as needed
- inspecting and testing connectors, wires, and printed circuit boards of gauge circuits and repairing or replacing, as needed
• diagnosing incorrect operation of warning devices and other driver information systems
• diagnosing intermittent, high, low, or no readings on electronic instrument clusters
• inspecting and testing sensors, sending units, connectors, and wires of electronic instrument circuits and repairing or replacing, as needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VI. Electrical/Electronic Systems
F. Instrument Cluster and Driver Information Systems Diagnosis and Repair
Task 1

Process/Skill Questions

• How would one describe a balancing-coil gauge system?
• How would the technician test a gauge sending unit?
• What is the purpose of the instrument voltage regulator (IVR)?

Task Number 150

Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine needed action.

Definition

Diagnosis should include

• inspecting, testing, and replacing oil temperature and pressure switches and sensors
• checking operation of parking brake indicator light system
• checking operation of brake stop light system and adjusting and servicing, as needed
• inspecting and testing gauges and gauge sending units and replacing, as needed
• inspecting and testing connectors, wires, and printed circuit boards of gauge circuits and repairing or replacing, as needed
• diagnosing incorrect operation of warning devices and other driver information systems
• diagnosing intermittent, high, low, or no readings on electronic instrument clusters
• inspecting and testing sensors, sending units, connectors, and wires of electronic instrument circuits and repairing or replacing, as needed.

The technician must use related service materials and follow manufacturer guidelines. (Note: Typically, digital and fiber optic gauges and warning circuits are not serviceable by the automotive service technician, but they are sent to special repair centers when servicing is
Process/Skill Questions

- What might be the cause of a constantly illuminated brake warning light?
- What is a driver information center?
- What might happen to the brakes if the anti-lock braking system (ABS) warning light is illuminated?

Body Electrical Systems Diagnosis and Repair

Task Number 151

Describe operation of comfort and convenience accessories and related circuits (e.g., power window, power seats, pedal height, power locks, truck locks, remote start, moon roof, sun roof, sun shade, remote keyless entry, voice activation, steering wheel controls, back-up camera, park assist, cruise control, and auto dimming headlamps); determine needed repairs.

Definition

Description should include

- identifying all components and systems related to comfort and convenience
- identifying acronyms used by manufacturers associated with components and systems (e.g., body control module [BCM], generic electronic module [GEM])
- following diagnostic flow chart provided by manufacturer.
Task 1

Process/Skill Questions

- How are these systems accessed?
- What is the importance of technical service bulletins (TSB) and service history?

Task Number 152

Describe operation of security/anti-theft systems and related circuits (e.g., theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed repairs.

Definition

Description should include

- identifying all components and systems related to security/anti-theft systems
- understanding the function of security/anti-theft systems
- identifying manufacturer-specific anti-theft system indicator.

Task 2

Process/Skill Questions

- How is a security/anti-theft system tested?
- What does the security/anti-theft system disable?
- What tools would be used to access security/anti-theft systems?
- What external indicators does the vehicle exhibit?

Task Number 153
Describe operation of entertainment and related circuits (e.g., radio, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed repairs.

Definition

Description should include

- identifying all entertainment components and related circuits
- understanding the function of entertainment and related circuits
- identifying manufacturer-specific entertainment and related circuits.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VI. Electrical/Electronic Systems
G. Body Electrical Systems Diagnosis and Repair
Task 3

Process/Skill Questions

- How are entertainment and related circuits tested?
- What is it important to use a battery keep-alive procedure while changing the battery?
- What tools would be used to access entertainment and related systems?

Task Number 154

Describe operation of safety systems and related circuits (e.g., horn, airbags, seat belt pretensioners, occupancy classification, wipers, washers, speed control/collision avoidance, heads-up display, park assist, and back-up camera); determine needed repairs.

Definition

Description should include

- identifying all safety components and related circuits
- understanding the function of safety systems and related circuits
- demonstrating the proper method of disabling SRS systems and associated safety.
Process/Skill Questions

- Why is it important to research and follow manufacturer’s safety procedures when working supplemental restraint systems (SRS)?
- Why is it important to follow manufacturer-specific procedures for other vehicle safety systems (e.g., crash avoidance, heads-up display)?

Task Number 155

Describe body electronic systems circuits using a scan tool; check for module communication errors (data bus systems); determine needed action.

Definition

Description should include

- identifying all components and systems related to body electronic systems circuits
- receiving and interpreting scan data.

Task Number 156

Process/Skill Questions

- Why is interpreting wiring diagrams important?
- Why is it important to follow a diagnostic flow chart?
Describe the process for software transfer, software updates, or reprogramming of electronic modules.

Definition

Description should include

- the process for software transfer, software updates, or reprogramming of electronic modules
- knowledge of the acquisition of manufacturer-specific proprietary information needed to reflash or reprogram
- difference between programmable read-only memory (PROM) and electrically erasable programmable read-only memory (EE-PROM)
- difference between programmable module installation (PMI) and non-programmable module installation.

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

General: Air Conditioning (AC) System Diagnosis and Repair

Task Number 157

Identify and interpret heating and air conditioning problems; determine needed action.

Definition
Procedure should include

- verifying customer concern
- determining proper function of any heating and air conditioning system component
- comparing component and function to a similar vehicle, if needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 1

Process/Skill Questions

- What tools are used in interpreting heating and air conditioning problems?
- What concerns are associated with heating and air conditioning?
- What is the first step in dealing with a heating and air conditioning concern?

Task Number 158

Test AC system; identify problems.

Definition

Performance test should include

- using industry temperature and pressure charts
- using manifold gauge set
- comparing results with manufacturer specifications for vehicle type.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 3

Process/Skill Questions

- What are the procedures to perform an AC performance test?
- What tools are used to perform an AC performance test?
- What problems can be identified by a performance test?
Task Number 159

Identify abnormal operating noises in the A/C system; determine needed action.

Definition

Identification should include

- determining the source (e.g., compressor, clutch, belt, pulleys, fans, refrigerant restrictions, blend door, heater blower motor) of any unusual noise
- following service materials and manufacturer guidelines to form a solution.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 4

Process/Skill Questions

- What can cause abnormal operating noises?
- How would a technician diagnose an abnormal noise in an AC system?
- What service precautions should be taken when working on an AC system?

Task Number 160

Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings.

Definition

Procedures should include using

- refrigerant identifier
- under-hood reference information
- service fittings
- proper gauge
- a thermometer to record ambient and in-dash temperature
• industry temperature and pressure charts
• federal laws and guidelines associated with the proper handling of refrigerants.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 5

Process/Skill Questions

• What tools should be used to identify the refrigerant type?
• Why should a technician check refrigerant type before servicing?
• What are the procedures for checking the refrigerant type?

Task Number 161

Leak test AC system; determine needed action.

Definition

Leak test should include using dyes or refrigerant leak detector and following service materials as well as federal and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 6

Process/Skill Questions

• What specialized tools are needed to perform a leak test on an AC system?
• What are the procedures to perform a leak test on an AC system?
• What are the safety and environmental concerns when performing a leak test on an AC system?

Task Number 162
Inspect condition of refrigerant oil removed from AC system; determine needed action.

Definition

Inspection should include visually checking the oil for presence of metal particles and servicing or changing the oil, as needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 7

Process/Skill Questions

- What tools and equipment are used to inspect the condition of refrigerant oil removed from the system?
- What are the proper procedures for measuring the amount of oil and inspecting it?
- How much oil should be returned to the system?

Task Number 163

Determine recommended oil and oil capacity for system application.

Definition

Determination should be made by referring to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 8

Process/Skill Questions

- Where would the technician find the oil capacity specification and oil type?
- How would the technician add oil to the system?
- How would incorrect oil type affect performance?
Task Number 164

Observe and record related HVAC data and trouble codes, using a scan tool.

Definition

Observation should include use of a scan tool. Diagnostic trouble codes (DTCs) should be interpreted by following symptom-based troubleshooting.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
A. General: Air Conditioning (A/C) System Diagnosis and Repair
Task 9

Process/Skill Questions

- What type of DTC does the AC system store?
- What are the benefits of using a bidirectional scan tool?
- What data can be seen on the scan tool?

Refrigeration System Component Diagnosis and Repair

Task Number 165

Inspect, test, service, and/or replace AC compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.

Definition

Procedures should include using specialized tools and referring to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
B. Refrigeration System Component Diagnosis and Repair

Task 2

Process/Skill Questions

• What tools are needed to adjust or replace AC clutch components?
• What procedures are used to adjust or replace AC clutch components?
• What is likely to occur if an AC clutch is misadjusted?

Task Number 166

Remove, inspect, and reinstall AC compressor and mountings; determine recommended oil type and quantity.

Definition

Procedure should include

• using proper refrigerant recovery equipment (required)
• draining oil from the component
• measuring the drained quantity (for reinstallation)
• replacing seals or O-rings
• following refrigerant handling guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
B. Refrigeration System Component Diagnosis and Repair
Task 3

Process/Skill Questions

• What tools are required to remove an AC compressor?
• What are the procedures to remove an AC compressor?
• How might the technician determine the required oil capacity in the AC compressor?

Task Number 167
Determine the need for an additional AC system filter.

Definition

Determination should include

- using proper refrigerant recovery equipment (required)
- identifying A/C compressor failure, and, if it has failed, adding a filter on the low-pressure line and other required components per manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
B. Refrigeration System Component Diagnosis and Repair
Task 5

Process/Skill Questions

- How and why would a technician install an AC filter?
- What procedures would one use to decide if a redundant AC filter is needed?
- What might be the source of debris or contamination that would require an additional filter?

Task Number 168

Remove and inspect AC system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.

Definition

Procedure should include

- using proper refrigerant recovery equipment (required)
- performing a visual inspection
- disposing of removed O-rings and seals
- lubricating new O-rings and seals prior to installation
- replacing additional components, according to service materials and manufacturer guidelines.
Task Number 169

Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil type and quantity.

Definition

Procedure should include

- using the proper refrigerant recovery equipment (required)
- draining oil from the component
- measuring the drained quantity for reinstallation
- replacing seals and O-rings.

Process/Skill Questions

- What specialized tools would be used for servicing a dryer?
- What safety procedures should be followed when servicing a dryer?
- What is the function of an accumulator/dryer?
Task Number 170

Remove, inspect, and install expansion valve or orifice (expansion) tube.

Definition

Procedure should include

• using proper refrigerant recovery equipment (required)
• replacing seals and O-rings.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
B. Refrigeration System Component Diagnosis and Repair
Task 9

Process/Skill Questions

• What specialized tools should be used when servicing the expansion valve or orifice (expansion) tube?
• What procedures are used to service the expansion valve or orifice (expansion) tube?
• What would happen if the expansion valve or orifice expansion tube was defective?

Task Number 171

Inspect evaporator housing water drain; determine needed action.

Definition

Procedure should include

• ensuring water drips from the water drain as the AC system operates
• cleaning, if necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
B. Refrigeration System Component Diagnosis and Repair
Task 10

Process/Skill Questions

- How does the water drain?
- Where is the drain located?
- What happens when the drain is restricted?

Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair

Task Number 172

Inspect and test heater control valve(s); determine needed action.

Definition

Procedure should include

- ensuring control lever moves with control head command
- referring to service information for additional test procedures.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair
Task 2

Process/Skill Questions

- If the vehicle is equipped with a heater control valve, where is it typically located?
- What is the corresponding customer complaint for a control valve that sticks in the closed position?
- How would the control valve affect the vehicle if the valve was stuck in the open position?

Operating Systems and Related Controls Diagnosis and Repair
Task Number 173

Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.

Definition

Procedure should include

- performing a visual inspection of components
- testing individual components
- following service materials and manufacturer guidelines.

Task Number 174

Diagnose HVAC system clutch control systems; determine needed action.

Definition

Diagnosis should include

- performing a visual inspection of clutch assembly, looking for evidence of excessive heat or oil contamination of clutch surfaces
- testing all circuits for sufficient voltage and proper grounding while activated
- testing related wiring and control components.
ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
D. Operating Systems and Related Controls Diagnosis and Repair
Task 2

Process/Skill Questions

- What are the tools needed to test and diagnose problems with the AC compressor clutch control systems?
- What are the procedures to test and diagnose problems with the AC compressor clutch control systems?
- What are the common failures of AC compressor clutch control systems?
- What adjustments might the technician need to make?

Task Number 175

Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the HVAC system; determine needed action.

Definition

Diagnosis should include

- verifying complaints
- checking for related problems
- using symptom-based diagnostic information
- performing appropriate tests to determine necessary repairs.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
D. Operating Systems and Related Controls Diagnosis and Repair
Task 3

Process/Skill Questions

- What tools are needed to diagnose malfunctions in the HVAC system?
- What procedures should be used to diagnose malfunctions in the HVAC system?
- What safety precautions should be followed when diagnosing malfunctions in the HVAC system?
Task Number 176

Inspect and test HVAC system control panel assembly; determine needed action.

Definition

Inspection should include

- actuating all functions of the control panel assembly
- determining the presence of any malfunctions
- referring to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
D. Operating Systems and Related Controls Diagnosis and Repair
Task 4

Process/Skill Questions

- What specialized tools should be used to test the HVAC controls?
- What procedures should be used to service the HVAC controls?
- What are some common problems with HVAC controls?

Task Number 177

Inspect and test HVAC system control cables, motors, and linkages; determine needed action.

Definition

Inspection should include

- performing a visual check of components for obvious defects
- testing individual components
- referring to service materials and manufacturer guidelines.
ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
D. Operating Systems and Related Controls Diagnosis and Repair
Task 5

Process/Skill Questions

• What procedures would a technician use to check AC-heater control cables, motors, and linkages?
• What are common problems with AC-heater control cables, motors, and linkages?
• What procedures should one follow to repair or replace AC-heater control cables, motors, and linkages?

Task Number 178

Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.

Definition

Inspection should include

• checking ducts, doors, and outlets for proper air flow
• determining cause of any obstructions or abnormal noise
• checking cabin filter for needed service.

Task Number 179

How should a technician inspect AC-heater ducts, doors, hoses, cabin filters, and outlets?
• How often should cabin filters be serviced?
• What might happen if the cabin filter becomes restricted?
Check operation of automatic or semi-automatic HVAC control systems; determine needed action.

Definition

Checking should include

- temperature control
- blend door/vent operation
- blower operation.

The technician should refer to service materials and manufacturer guidelines to repair any defects found.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
D. Operating Systems and Related Controls Diagnosis and Repair
Task 8

Process/Skill Questions

- What tools are used to check automatic or semi-automatic HVAC systems?
- What are common problems with automatic or semi-automatic HVAC systems?
- What procedures should be followed when servicing automatic or semi-automatic HVAC systems?

Refrigerant Recovery, Recycling, and Handling

Task Number 180

Use and maintain refrigerant handling equipment, according to equipment manufacturer’s standards.

Definition

Procedures should include

- performing routine service and maintenance of all recovery equipment, including servicing filters
• purging oil
• following manufacturer guidelines
• following federal guidelines for disposal of refrigerants.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
E. Refrigerant Recovery, Recycling and Handling
Task 1

Process/Skill Questions

• Which Environmental Protection Agency (EPA) laws address the handling of refrigerants, and what do they require?
• What color is an R-134a storage container? An R-12 storage container?
• What is the difference between recovering and recycling?

Task Number 181

Identify AC system refrigerant; test for sealants; recover, evacuate, and charge AC system; add refrigerant oil as required.

Definition

Identification should include

• identification labels on the vehicle
• correct fittings for the label
• use of a refrigerant identifier.

Recovery should include evacuating refrigerant with matching machine (e.g., R-12, R-134a).

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
E. Refrigerant Recovery, Recycling and Handling
Task 2

Process/Skill Questions

• How does a technician identify the type of refrigerant used?
- What tools or equipment are used to identify and recover AC system refrigerant?
- Why are EPA laws for AC refrigerant recovery necessary?

---

**Task Number 182**

Recycle, label, and store refrigerant.

**Definition**

Procedure should include

- identifying refrigerant for recycling
- using recovery equipment
- labeling and using only the approved storage containers for refrigerant type
- keeping storage area in compliance with industry standards.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VII. Heating, Ventilation, and Air Conditioning (HVAC)
E. Refrigerant Recovery, Recycling and Handling
Task 3

**Process/Skill Questions**

- What license should a technician have to handle refrigerant?
- What type of equipment is used to recover, recycle, and store refrigerant?
- What is the fine for improperly handling refrigerant?
- Who regulates the handling of refrigerant?

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**ENGINE PERFORMANCE**

**General: Engine Diagnosis**

**Task Number 183**

Identify and interpret engine performance concerns; determine needed action.

**Definition**
Interpretation should include

- verifying the customer concern
- determining the proper function of relevant engine component
- checking for engine modifications
- comparing component and function to a similar vehicle, if needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
A. General Engine Diagnosis
Task 1

Process/Skill Questions

- What information is needed from customers before a technician can begin to diagnose a problem?
- What is the first step in diagnosing the customer concern?
- What should be done if the technician cannot duplicate the problem?

Task Number 184

Diagnose abnormal engine noises or vibration concerns; determine needed action.

Definition

Diagnosis should include

- searching for loose components
- checking for misalignment of components
- listening unaided or with a stethoscope or other sound detector to locate source of noise
- locating vibrations caused by a misfire or by worn/faulty components
- using a scan tool to isolate misfires.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
A. General Engine Diagnosis
Task 3

Process/Skill Questions
• What tool would the technician use to pinpoint the source of a noise?
• How can engine mount vibrations be tested?
• What would a low, knocking noise indicate?
• What are the differences between high- and low-speed noise/vibrations?

Task Number 185

Diagnose the cause of excessive oil consumption and unusual exhaust color, odor, and sound; determine needed action.

Definition

Diagnosis should include

• smelling the exhaust
• observing the exhaust color
• listening for uneven exhaust pulses (misfiring) and restriction noises (hissing)
• examining areas where oil may be leaking or burning (by using dyes)
• changing the oil and observing oil consumption
• conducting a pressure check to determine coolant consumption
• repairing as needed.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
A. General Engine Diagnosis
Task 4

Process/Skill Questions

• What does blue smoke indicate?
• What does black smoke indicate?
• What does white smoke indicate?
• What causes a rotten egg smell?

Task Number 186

Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.
Definition

Diagnosis should include performing

- engine-based tests (mechanical) prior to other testing
- an engine compression test
- a cylinder leak test
- a vacuum test
- a power balance test
- an ignition system test (using an oscilloscope)
- diagnostics with a scan tool
- fuel pressure and volume tests.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
A. General Engine Diagnosis
Task 9

Process/Skill Questions

- How can mechanical engine concerns affect driveability?
- What are some effects of improper camshaft timing?
- What are possible causes of an engine miss?

Task Number 187

Verify correct camshaft timing, including variable valve timing (VVT) systems.

Definition

Verification should include

- removing covers, as needed
- comparing marks to specifications for proper alignment.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
A. General Engine Diagnosis
Task 11
Process/Skill Questions

- What other components might be affected by improper timing?
- What might be the result of not maintaining correct camshaft timing?
- How is a timing light used to help verify camshaft timing?

Computerized Controls Diagnosis and Repair

Task Number 188

Research service information to perform step-by-step diagnosis (troubleshooting).

Definition

Research should include using service materials and manufacturer guidelines or aftermarket service information and diagnostic troubleshooting charts.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
B. Computerized Controls Diagnosis and Repair
Task 2

Process/Skill Questions

- What are some proprietary distributors of service information?
- What character in the vehicle identification number (VIN) identifies the engine?
- What should the technician do if the problem is not diagnosed and fixed after following service troubleshooting procedures?

Task Number 189

Perform active tests of actuators using a scan tool; determine needed action.

Definition

Procedure should include actuating circuits, using the scan tool and tests (e.g., cooling fan, AC clutch, balance test).
Process/Skill Questions

- How can actuator tests with a scan tool assist with diagnosis?
- What are potential safety issues when using actuator tests?
- What would necessitate an actuator test?

Ignition System Diagnosis and Repair

Task Number 190

Diagnose (troubleshoot) ignition system-related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action.

Definition

Diagnosis should include

- performing basic charging, battery, and starting system tests
- using specialized tools (e.g., spark tester, oscilloscope, graphing meter, gas analyzer, DMM, scan tool)
- adhering to service materials and manufacturer guidelines.

Process/Skill Questions

- What might result in a no-start?
- What could produce a spark knock?
- What might cause high fuel consumption?
Task Number 191

Inspect and test crankshaft and camshaft position sensor(s); determine needed action.

Definition

Procedure should include

- following troubleshooting charts
- using a scan tool, DMM, oscilloscope, and/or graphing meter
- adhering to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
C. Ignition System Diagnosis and Repair
Task 2

Process/Skill Questions

- What is a crankshaft sensor relearn procedure?
- Why is air gap important?
- What are the types of signals produced by cam and crank sensors?

Task Number 192

Inspect, test, and/or replace ignition control module and powertrain/engine control module; reprogram/initialize as needed.

Definition

Procedure should include

- following troubleshooting charts
- using a scan tool, DMM, oscilloscope, and/or graphing meter
- adhering to service materials and manufacturer guidelines.
(Note: Technician should participate in a lab/shop demonstration for reprogramming modules.)

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
C. Ignition System Diagnosis and Repair
Task 3

Process/Skill Questions

- What is the major solid-state component of an ignition control module?
- Where might the ignition control module be located?
- What are different types of triggers for the primary circuit?

Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

Task Number 193

Check fuel for contaminants; determine needed action.

Definition

Check should include

- using a graduated beaker to test for water or alcohol content
- referring to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
Task 1

Process/Skill Questions

- What is a fuel contaminant?
- How might fuel become contaminated?
- How does alcohol content affect mileage?
Task Number 194

Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; determine needed action.

Definition

Procedure should include

- using a fuel pressure gauge
- performing a flow test with a graduated cylinder and stopwatch
- referring to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
Task 2

Process/Skill Questions

- What methods are used to control fuel pressure?
- What lubricates the electric fuel pump?
- Why doesn’t the electric fuel pump create a fire hazard?

Task Number 195

Inspect throttle body, air induction system, intake manifold, and gaskets for vacuum leaks and/or unmetered air.

Definition

Procedure should include

- using a scan tool
- monitoring data and comparing results to service materials and manufacturer guidelines
- performing a propane test, if necessary.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

Task 5

Process/Skill Questions

• What is unmetered air?
• How will unmetered air affect air-fuel (stoichiometric) ratio?
• How will a vacuum leak affect idle speed?

Task Number 196

Inspect test, and/or replace fuel injectors.

Definition

Procedure should include performing the following tests:

• Coil resistance test (ohmmeter)
• Flow test
• Oscilloscope signature test, checking for leaking nozzle and for presence of contaminated oil

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
Task 6

Process/Skill Questions

• What specialized tools may be necessary to test fuel injectors?
• What noise does an operating fuel injector make?
• Why is it important to identify fuel injector impedance before deciding to replace it?
• Why do fuel injectors have different colored electrical connections?

Task Number 197

Verify idle control operation.

Definition
Verification should include

- using a scan tool to perform output test for idle air control (IAC)
- comparing actual idle speed to target idle
- referring to service materials and manufacturer guidelines.

**ASE Education Foundation**

**2017 Automobile Service Technology (AST) Level**

**VIII. Engine Performance**

**D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair**

**Task 7**

**Process/Skill Questions**

- What are the differences in methods of idle speed control?
- What is a fly-by wire? What is ETC? (electronic throttle control)
- How does a stepper motor operate?

---

**Task Number 198**

**Perform exhaust system back-pressure test; determine needed action.**

**Definition**

Procedure should include conducting tests, using

- vacuum gauge
- fuel pressure gauge/back pressure gauge
- oxygen (O2) sensor or air pump
- DMM with pressure transducers.

**ASE Education Foundation**

**2017 Automobile Service Technology (AST) Level**

**VIII. Engine Performance**

**D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair**

**Task 10**

**Process/Skill Questions**

- What performance problems might be caused by a restricted exhaust?
- What DTC could be prompted by a restricted exhaust?
Emissions Control Systems Diagnosis and Repair

Task Number 199

Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.

Definition

Diagnosis should include

- checking for the presence of excessive oil in the air induction system
- checking for a plugged vacuum port/line in the PCV
- ensuring the proper PCV valve is used
- checking for proper PCV filter/breather function.

Task Number 200

Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service, and/or replace components of electrical/electronic sensors, controls, wiring, tubing, exhaust passages,
vacuum/pressure controls, filters, and hoses of EGR system; determine necessary action.

Definition

Diagnosis should include

- using a five-gas analyzer
- using a scan tool
- interpreting emissions testing results
- troubleshooting charts
- comparing test results to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
E. Emissions Control Systems Diagnosis and Repair
Task 3

Process/Skill Questions

- What might the typical customer complaint be for a stuck-open EGR valve?
- What might be the consequences of having a plugged EGR system?
- What is the function/operation of the EGR system?

Task Number 201

Inspect and test electrical/electronically operated components and circuits of secondary air-injection systems; determine needed action.

Definition

Inspection should include using troubleshooting charts and comparing test results to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
E. Emissions Control Systems Diagnosis and Repair
Task 4
Process/Skill Questions

- When does the air-injection pump run?
- Why are diverter valves not typically used on electrically operated air injection systems?
- What device controls the air-injection pump?

Task Number 202

Diagnose emission and driveability concerns caused by the catalytic converter system; determine needed action.

Definition

Procedure should include

- using the scan tool and performing a temperature test or using a five-gas analyzer to test efficiency
- using manifold vacuum readings
- referring to service materials and manufacturer guidelines.

Task Number 203

Inspect and test components and hoses of the evaporative emissions control (EVAP) system; determine needed action.

Definition
Procedure should include

- performing a visual inspection
- using a smoke machine (optional)
- comparing test results to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
E. Emissions Control Systems Diagnosis and Repair
Task 6

Process/Skill Questions

- What tool is used to inspect hoses in the evaporative system?
- What are the leak-testing methods used by manufacturers?
- Why do evaporative emissions need to be controlled?

Task Number 204

Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine needed action.

Definition

Interpretation should include

- using a scan tool
- using diagnostic troubleshooting charts
- comparing test results to service materials and manufacturer guidelines.

ASE Education Foundation
2017 Automobile Service Technology (AST) Level
VIII. Engine Performance
E. Emissions Control Systems Diagnosis and Repair
Task 7

Process/Skill Questions

- What is the function of a charcoal canister?
- What is the function of a purge solenoid?
- How can data be saved while driving?

## SOL Correlation by Task

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Subject Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>Identify general lab/shop safety rules and procedures.</td>
<td>History and Social Science: GOVT.14</td>
</tr>
<tr>
<td>40</td>
<td>Utilize safe procedures for handling tools and equipment.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>41</td>
<td>Identify and use proper placement of floor jacks and jack stands.</td>
<td>History and Social Science: GOVT.14</td>
</tr>
<tr>
<td>42</td>
<td>Identify and use proper procedures for safe lift operation.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>43</td>
<td>Use proper ventilation procedures for working in the lab/shop area.</td>
<td>History and Social Science: GOVT.14</td>
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<tr>
<td>44</td>
<td>Identify marked safety areas.</td>
<td>English: 12.5</td>
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<tr>
<td>45</td>
<td>Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>46</td>
<td>Identify the location and use of eye wash stations.</td>
<td>History and Social Science: GOVT.14</td>
</tr>
<tr>
<td>47</td>
<td>Identify the location of posted evacuation routes.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>48</td>
<td>Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.</td>
<td>History and Social Science: GOVT.14</td>
</tr>
<tr>
<td>49</td>
<td>Identify and wear appropriate clothing for lab/shop activities.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>50</td>
<td>Secure hair and jewelry for lab/shop activities.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>51</td>
<td>Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high-voltage circuits.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>52</td>
<td>Demonstrate awareness of the safety aspects of high-voltage circuits such as high intensity discharge (HID) lamps, ignition systems, and injection systems.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>53</td>
<td>Locate and demonstrate knowledge of safety data sheets (SDS).</td>
<td>History and Social Science: GOVT.14</td>
</tr>
<tr>
<td>54</td>
<td>Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.</td>
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<tr>
<td>55</td>
<td>Inspect, remove, and/or replace engine mounts.</td>
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<tr>
<td>56</td>
<td>Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten, according to manufacturer’s specifications and procedures.</td>
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</tr>
<tr>
<td>57</td>
<td>Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.</td>
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<tr>
<td>58</td>
<td>Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages; determine necessary action.</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components); verify correct camshaft timing.</td>
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<tr>
<td>60</td>
<td>Establish camshaft position sensor indexing.</td>
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<tr>
<td>61</td>
<td>Remove, inspect, and/or replace crankshaft vibration damper (harmonic balancer).</td>
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<tr>
<td>62</td>
<td>Identify causes of engine overheating.</td>
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<td>63</td>
<td>Inspect, remove, and replace water pump.</td>
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<tr>
<td>64</td>
<td>Remove and replace radiator.</td>
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<tr>
<td>65</td>
<td>Inspect and test fan(s), fan clutch (electrical or mechanical), fan shroud, and air dams; determine needed action.</td>
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<tr>
<td>66</td>
<td>Perform oil pressure tests; determine needed action.</td>
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<tr>
<td>67</td>
<td>Inspect auxiliary coolers; determine needed action.</td>
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<tr>
<td>68</td>
<td>Inspect, test, and replace oil temperature and pressure switches and sensors.</td>
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<tr>
<td>69</td>
<td>Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action.</td>
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<tr>
<td>70</td>
<td>Diagnose fluid loss and condition concerns; determine necessary action.</td>
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<td>71</td>
<td>Perform stall test; determine needed action.</td>
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<tr>
<td>72</td>
<td>Perform lock-up converter system tests; determine needed action.</td>
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<tr>
<td>73</td>
<td>Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.</td>
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</tr>
<tr>
<td>74</td>
<td>Diagnose pressure concerns in a transmission, using hydraulic principles (Pascal’s law).</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits, including computers, solenoids, sensors, relays, terminals,</td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>Description</td>
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<tr>
<td>76</td>
<td>Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mounting surfaces.</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings.</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>Identify and interpret drive train concerns; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable).</td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>Bleed clutch hydraulic system.</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification.</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>Inspect flywheel and ring gear for wear and cracks; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>Measure flywheel runout and crankshaft end play; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers.</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>Diagnose universal joint noise and vibration concerns; perform necessary action.</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.</td>
<td></td>
</tr>
<tr>
<td>91</td>
<td>Inspect and replace companion flange and/or pinion seal; measure companion flange runout.</td>
<td></td>
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<tr>
<td>92</td>
<td>Remove and replace drive axle shafts.</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>Inspect and replace drive axle shaft seals, bearings, and retainers.</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>Measure drive axle flange runout and shaft end play; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>Inspect, adjust, and repair shifting controls (e.g., mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>Identify concerns related to variations in tire circumference and/or final drive ratios.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>97</td>
<td>Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.</td>
<td></td>
</tr>
<tr>
<td>98</td>
<td>Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action.</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Diagnose power steering gear (i.e., non-rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>Diagnose power steering gear (i.e., rack-and-pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>102</td>
<td>Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock-cylinder mechanism, and steering wheel; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>103</td>
<td>Remove and replace rack-and-pinion steering gear; inspect mounting bushings and brackets.</td>
<td></td>
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<tr>
<td>104</td>
<td>Remove and reinstall power steering pump.</td>
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</tr>
<tr>
<td>105</td>
<td>Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.</td>
<td></td>
</tr>
<tr>
<td>106</td>
<td>Inspect, remove, and or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.</td>
<td></td>
</tr>
<tr>
<td>107</td>
<td>Inspect, replace, and/or adjust tie rod ends (sockets), tie rod sleeves, and clamps.</td>
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</tr>
<tr>
<td>108</td>
<td>Diagnose short- and long-arm suspension system noises, body sway, and uneven ride height concerns; determine needed action.</td>
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</tr>
<tr>
<td>109</td>
<td>Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action.</td>
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</tr>
<tr>
<td>110</td>
<td>Inspect, remove and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers.</td>
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</tr>
<tr>
<td>111</td>
<td>Inspect, remove, and/or replace strut rods and bushings.</td>
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</tr>
<tr>
<td>112</td>
<td>Inspect, remove and/or replace steering knuckle assemblies.</td>
<td></td>
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<tr>
<td>113</td>
<td>Inspect, remove, and/or replace short- and long-arm suspension system coil springs and spring insulators.</td>
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<tr>
<td>114</td>
<td>Inspect, remove, and/or replace torsion bars and mounts.</td>
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</tr>
<tr>
<td>115</td>
<td>Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.</td>
<td></td>
</tr>
<tr>
<td>116</td>
<td>Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.</td>
<td></td>
</tr>
<tr>
<td>117</td>
<td>Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.</td>
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</tr>
<tr>
<td>118</td>
<td>Remove, inspect, service, and/or replace front and rear wheel bearings.</td>
<td></td>
</tr>
<tr>
<td>119</td>
<td>Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber, and toe as required; center steering wheel.</td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>Check toe-out on turns (i.e., turning radius); determine needed action.</td>
<td></td>
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<tr>
<td>122</td>
<td>Check steering axis inclination (SAI) and included angle; determine needed action.</td>
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<tr>
<td>123</td>
<td>Check rear-wheel thrust angle; determine needed action.</td>
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</tr>
<tr>
<td>124</td>
<td>Check for front-wheel setback; determine needed action.</td>
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<tr>
<td>125</td>
<td>Check front and/or rear cradle (subframe) alignment; determine needed action.</td>
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<tr>
<td>126</td>
<td>Diagnose wheel/tire vibration, shimmy, and noise; determine needed action.</td>
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<tr>
<td>127</td>
<td>Measure wheel, tire, axle flange, and hub runout; determine needed action.</td>
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<tr>
<td>128</td>
<td>Diagnose tire pull problems; determine needed action.</td>
<td></td>
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<tr>
<td>129</td>
<td>Identify and interpret brake system concerns; determine needed action.</td>
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<tr>
<td>130</td>
<td>Diagnose pressure concerns in the brake system using hydraulic principles (Pascal’s law). Science: PH.7</td>
<td></td>
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<tr>
<td>131</td>
<td>Remove, bench bleed, and reinstall master cylinder.</td>
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<tr>
<td>132</td>
<td>Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine needed action.</td>
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<tr>
<td>133</td>
<td>Replace brake lines, hoses, fittings, and supports.</td>
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</tr>
<tr>
<td>134</td>
<td>Fabricate brake lines, using proper material and flaring procedures (e.g., double flare and International Standards Organization [ISO] types).</td>
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</tr>
<tr>
<td>135</td>
<td>Inspect, test, and/or replace components of brake warning light system.</td>
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<tr>
<td>136</td>
<td>Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine needed action.</td>
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</tr>
<tr>
<td>137</td>
<td>Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine needed action.</td>
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<tr>
<td>138</td>
<td>Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine needed action.</td>
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<tr>
<td>139</td>
<td>Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine needed action.</td>
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<tr>
<td>Task Number</td>
<td>Task Description</td>
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<tr>
<td>140</td>
<td>Measure and adjust master cylinder pushrod length.</td>
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<tr>
<td>141</td>
<td>Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine needed action.</td>
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<tr>
<td>142</td>
<td>Remove, reinstall, and/or replace sealed wheel bearing assembly.</td>
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<tr>
<td>143</td>
<td>Identify and inspect electronic brake control system components (e.g., ABS, TCS, ESC); determine needed action.</td>
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<tr>
<td>144</td>
<td>Diagnose the cause(s) of excessive key-off battery drain (i.e., parasitic draw); determine needed action.</td>
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<tr>
<td>145</td>
<td>Repair data bus wiring harness.</td>
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<tr>
<td>146</td>
<td>Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.</td>
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</tr>
<tr>
<td>147</td>
<td>Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.</td>
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<tr>
<td>148</td>
<td>Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action.</td>
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<tr>
<td>149</td>
<td>Inspect and test gauges and gauge sending units for causes of abnormal readings; determine needed action.</td>
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<tr>
<td>150</td>
<td>Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine needed action.</td>
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<tr>
<td>151</td>
<td>Describe operation of comfort and convenience accessories and related circuits (e.g., power window, power seats, pedal height, power locks, truck locks, remote start, moon roof, sun roof, sun shade, remote keyless entry, voice activation, steering wheel controls, back-up camera, park assist, cruise control, and auto dimming headlamps); determine needed repairs.</td>
<td></td>
</tr>
<tr>
<td>152</td>
<td>Describe operation of security/anti-theft systems and related circuits (e.g., theft deterrent, door locks, remote keyless entry, remote start, and starter/fuel disable); determine needed repairs.</td>
<td></td>
</tr>
<tr>
<td>153</td>
<td>Describe operation of entertainment and related circuits (e.g., radio, navigation, amplifiers, speakers, antennas, and voice-activated accessories); determine needed repairs.</td>
<td></td>
</tr>
<tr>
<td>154</td>
<td>Describe operation of safety systems and related circuits (e.g., horn, airbags, seat belt pretensioners, occupancy classification, wipers, washers, speed control/collision avoidance, heads-up display, park assist, and back-up camera); determine needed repairs.</td>
<td></td>
</tr>
<tr>
<td>155</td>
<td>Describe body electronic systems circuits using a scan tool; check for module communication errors (data bus systems); determine needed action.</td>
<td></td>
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<tr>
<td>156</td>
<td>Describe the process for software transfer, software updates, or reprogramming of electronic modules.</td>
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<tr>
<td>157</td>
<td>Identify and interpret heating and air conditioning problems; determine needed action.</td>
<td></td>
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<tr>
<td>158</td>
<td>Test AC system; identify problems.</td>
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<td></td>
<td>Task Description</td>
<td>English: 12.5</td>
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<tr>
<td>159</td>
<td>Identify abnormal operating noises in the A/C system; determine needed action.</td>
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<tr>
<td>160</td>
<td>Identify refrigerant type; select and connect proper gauge set/test equipment; record temperature and pressure readings.</td>
<td></td>
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<tr>
<td>161</td>
<td>Leak test AC system; determine needed action.</td>
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<tr>
<td>162</td>
<td>Inspect condition of refrigerant oil removed from AC system; determine needed action.</td>
<td></td>
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<tr>
<td>163</td>
<td>Determine recommended oil and oil capacity for system application.</td>
<td></td>
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<tr>
<td>164</td>
<td>Observe and record related HVAC data and trouble codes, using a scan tool.</td>
<td></td>
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<tr>
<td>165</td>
<td>Inspect, test, service, and/or replace AC compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.</td>
<td></td>
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<tr>
<td>166</td>
<td>Remove, inspect, and reinstall AC compressor and mountings; determine recommended oil type and quantity.</td>
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<tr>
<td>167</td>
<td>Determine the need for an additional AC system filter.</td>
<td></td>
</tr>
<tr>
<td>168</td>
<td>Remove and inspect AC system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>169</td>
<td>Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil type and quantity.</td>
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<tr>
<td>170</td>
<td>Remove, inspect, and install expansion valve or orifice (expansion) tube.</td>
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<tr>
<td>171</td>
<td>Inspect evaporator housing water drain; determine needed action.</td>
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<tr>
<td>172</td>
<td>Inspect and test heater control valve(s); determine needed action.</td>
<td></td>
</tr>
<tr>
<td>173</td>
<td>Inspect and test HVAC system blower motors, resistors, switches, relays, wiring, and protection devices; determine needed action.</td>
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</tr>
<tr>
<td>174</td>
<td>Diagnose HVAC system clutch control systems; determine needed action.</td>
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</tr>
<tr>
<td>175</td>
<td>Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the HVAC system; determine needed action.</td>
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</tr>
<tr>
<td>176</td>
<td>Inspect and test HVAC system control panel assembly; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>177</td>
<td>Inspect and test HVAC system control cables, motors, and linkages; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>178</td>
<td>Inspect HVAC system ducts, doors, hoses, cabin filters, and outlets; determine needed action.</td>
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<tr>
<td>179</td>
<td>Check operation of automatic or semi-automatic HVAC control systems; determine needed action.</td>
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<tr>
<td>180</td>
<td>Use and maintain refrigerant handling equipment, according to equipment manufacturer’s standards.</td>
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</tr>
<tr>
<td>181</td>
<td>Identify AC system refrigerant; test for sealants; recover, evacuate, and charge AC system; add refrigerant oil as required.</td>
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<tr>
<td>182</td>
<td>Recycle, label, and store refrigerant.</td>
<td></td>
</tr>
<tr>
<td>183</td>
<td>Identify and interpret engine performance concerns; determine needed action.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>184</td>
<td>Diagnose abnormal engine noises or vibration concerns; determine needed action.</td>
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<tr>
<td>185</td>
<td>Diagnose the cause of excessive oil consumption and unusual exhaust color, odor, and sound; determine needed action.</td>
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<tr>
<td>186</td>
<td>Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>187</td>
<td>Verify correct camshaft timing, including variable valve timing (VVT) systems.</td>
<td></td>
</tr>
<tr>
<td>188</td>
<td>Research service information to perform step-by-step diagnosis (troubleshooting).</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td>189</td>
<td>Perform active tests of actuators using a scan tool; determine needed action.</td>
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</tr>
<tr>
<td>190</td>
<td>Diagnose (troubleshoot) ignition system-related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>191</td>
<td>Inspect and test crankshaft and camshaft position sensor(s); determine needed action.</td>
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</tr>
<tr>
<td>192</td>
<td>Inspect, test, and/or replace ignition control module and powertrain/engine control module; reprogram/initialize as needed.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>193</td>
<td>Check fuel for contaminants; determine needed action.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>194</td>
<td>Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; determine needed action.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>195</td>
<td>Inspect throttle body, air induction system, intake manifold, and gaskets for vacuum leaks and/or unmetered air.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>196</td>
<td>Inspect test, and/or replace fuel injectors.</td>
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<tr>
<td>197</td>
<td>Verify idle control operation.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>198</td>
<td>Perform exhaust system back-pressure test; determine needed action.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>199</td>
<td>Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine needed action.</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; inspect, test, service, and/or replace components of electrical/electronic sensors, controls, wiring, tubing, exhaust passages, vacuum/pressure controls, filters, and hoses of EGR system; determine necessary action.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>201</td>
<td>Inspect and test electrical/electronically operated components and circuits of secondary air-injection systems; determine needed action.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>202</td>
<td>Diagnose emission and driveability concerns caused by the catalytic converter system; determine needed action.</td>
<td>English: 12.5</td>
</tr>
</tbody>
</table>
Customer Service Infusion Units

Customer Service Infusion Units (CSIU) were designed to be infused with designated CTE courses to help students in those programs achieve additional, focused, validated tasks/competencies in customer service. These units are not mandatory, and, as such, the tasks/competencies are marked as "optional," to be taught at the instructor's discretion. Teachers can find the infusion/unit in the course listing.

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.” Teachers can find the infusion/unit in the course listing.

SkillsUSA Championship Competitive Events

SkillsUSA is a national membership association serving high school, college and middle school students who are preparing for careers in trade, technical and skilled service occupations, including health occupations, and for further education. SkillsUSA is a partnership of students, teachers and industry working together to ensure America has a skilled workforce. SkillsUSA helps each student excel.

SkillsUSA is an Applied Method of Learning where students practice skills and build self-confidence while helping their schools and communities. SkillsUSA provides experiences in leadership, teamwork, citizenship and character development. The program emphasizes high ethical standards, superior work skills, lifelong education and pride. These are qualities employers value and look for when hiring or promoting workers.

Mission: SkillsUSA empowers its members to become world-class workers, leaders and responsible American citizens. SkillsUSA improves the quality of our nation’s future skilled workforce through the development of Framework skills that include personal, workplace and technical skills grounded in academics.

Vision: SkillsUSA produces the most highly skilled workforce in the world, providing every member the opportunity for career success.
Resources: SkillsUSA offers many resources for educators and students. For additional information about the student organization, see SkillsUSA National Website at www.skillsusa.org and the SkillsUSA Virginia Website at www.skillsusava.org.

SkillsUSA Championships Events: The official regulations for the following events are published in the SkillsUSA Championships Technical Standards. New contests are added each year.

The SkillsUSA Championships brings together industry and labor representatives, educators and the public to watch students compete in leadership and hands-on skill events for a full day. The SkillsUSA Championships begin at the local level with contests in classrooms nationwide. Winners advance through district, regional and state competition, and only the best make it to the national event. Students benefit no matter how they place in their contests. They test their skills, frequently make job contacts, and have a chance for recognition. State and national winners receive gold, silver and bronze medallions, scholarships, tools and other awards as provided by business and industry partners.

(#) Contest not currently offered in Virginia
(*) Contest for students with IEP only

Leadership Development

Action Skills *
American Spirit Chapter
Business Procedure #
Chapter Display
Community Action Project*
Community Service
Employment Application Process *
Extemporaneous Speaking
Job Interview
Job Skill Demonstration A
Job Skill Demonstration Open
Occupational Health and Safety
Opening and Closing Ceremonies
Outstanding Chapter
Pin Design (State Conference)
Prepared Speech
Promotional Bulletin Board
Quiz Bowl
T-shirt Design

Occupationally Related
Career Pathways Showcase
Customer Service
Engineering Technology/Design
Entrepreneurship
First Aid/CPR
Health Knowledge Bowl #
Health Occupations Professional Portfolio
Medical Math
Medical Terminology
Principles of Engineering/Technology
Related Technical Math
Team Engineering Challenge #

**Skilled and Technical Sciences**
3-D Visualization and Animation
Additive Manufacturing
Advertising Design
Architectural Drafting
Audio/Radio Production
Automated Manufacturing Technology #
Automotive Refinishing Technology
Automotive Service Technology
Automotive: Maintenance and Light Repair (S)
Aviation Maintenance Technology
Barbering
Basic Health Care Skills #
Broadcast News Production
Building Maintenance
Cabinetmaking
Carpentry
CNC Milling Specialist
CNC Technician
CNC Turning Specialist
Collision Damage Appraisal #
Collision Repair Technology
Commercial Baking
Computer Programming
Cosmetology
Crime Scene Investigation
Criminal Justice
Culinary Arts
Dental Assisting
Diesel Equipment Technology
Digital Cinema Technology
Early Childhood Education
Electrical Construction Wiring
Electronics Technology
Esthetics
Firefighting
Graphic Communications
Graphics Imaging – Sublimation
Heating, Ventilation, Air Conditioning and Refrigeration
Humanoid Robotics 
Industrial Motor Control
Information Technology Services
Interactive Application and Video Game Development
Internetworking
Major Appliance and Refrigeration Technology 
Marine Service Technology
Masonry
Mechatronics
Medical Assisting 
Mobile Electronics Installation 
Mobile Robotics Technology
Motorcycle Service Technology
Nail Care
Nurse Assisting
Photography
Plumbing
Power Equipment Technology
Practical Nursing 
Residential Systems Installation and Maintenance 
Restaurant Service
Robotics: Urban Search and Rescue
Robotics and Automation Technology 
Screen Printing Technology
Sheet Metal 
TeamWorks
Technical Computer Applications
Technical Drafting
Telecommunications Cabling
Television (Video) Production
Web Design
Welding
Welding Fabrication
Welding Sculpture

**State Only Contest** (not national contest)
Auto Maintenance *
Barbering Bricklayer *
Club Scrapbook
Current Events
Emergency Medical Technician
Essay
Extemporaneous Writing
Fantasy Manikin (Live)
Food Preparation Assistant *
Occupational Display
Occupational Scrapbook
Poster
Precision Machining Technology
Promotional Flyer
Radio Communications (Pre-Produced)
Spelling
Student of the Year
Television Production (Pre-Produced Cut-Only)
Television Production (Pre-Produced Special Effects)
Veterinary Assisting
Appendix: Credentials and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- ASE Certification Examinations
- ASE Entry-Level Certification Examinations
- Automotive Technician Advanced Assessment
- Automotive Technician Core Assessment
- College and Work Readiness Assessment (CWRA+)
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- Mobile Communications and Electronics Installer (MCEI) Examination
- National Career Readiness Certificate Assessment
- Professional Communications Certification Examination
- Virginia Motor Vehicle Safety Inspection Program Examination
- Workplace Readiness Skills for the Commonwealth Examination

<table>
<thead>
<tr>
<th>Career Cluster: Transportation, Distribution and Logistics</th>
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<tbody>
<tr>
<td><strong>Pathway</strong></td>
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</table>
| Facility and Mobile Equipment Maintenance | Aircraft Mechanic and Service Technician  
Aircraft Structure, Surfaces, Rigging, and Systems Assembler  
Automotive Body and Related Repairer  
Automotive Glass Installer and Repairer  
Automotive Service Technician, Mechanic  
Diesel Service Technician  
Electrical and Electronic Installer  
Electrical and Electronic Repairer  
Marine Watercraft Repair and Maintenance Worker  
Motorboat Mechanic  
Service Technician  
Small Engine Mechanic |
| Health, Safety and Environmental Management | Health, Safety, and Environment Manager |